Cross Connection Control

Basic Workshop
#2103

Renewal Workshop
#3102

Fleming Training Center
2022 Blanton Drive
Murfreesboro, TN 37129

Revised November 2007

Cross Connection

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INTRODUCTION

Cross Connection Control Basic Class #2103
and
Cross Connection Control Renewal Class #3102

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For technical assistance on cross-connection control, backflow issues, assemblies, assembly installation, Cross-Connection Control Programs, Plans, Policies, Ordinances contact:

Travis Aslinger
Division of Water Supply

Phone (615) 532-9199
Email: James.T.Aslinger @state.tn.us

Helpful website addresses:

Fleming Training Center	www.state.tn.us/environment/fleming
Foundation for Cross Connection Control and Hydraulic Research	www.usc.edu/dept/fccchr
Safe-T-Cover Enclosures	www.safe-t.cover.com
Hot Box Enclosures	www.hot-box.com
Tennessee Chapter of the American Backflow Prevention Association	www.tnbackflow.com
American Backflow Prevention Association	www.abpa.org
Backflow Apparatus & Valve Co. (BAVCO)	www.bavco.com
Division of Water Supply, Drinking Water Program (Training videos, manuals, etc.)	http://www.state.tn.us/environment/dws/DWprogram.shtml

JULIAN R. FLEMING TRAINING CENTER
BUILDING RULES

We appreciate your interest in the Julian R. Fleming Environmental Training Center and trust that your time at the Center will be pleasurable. We ask that you please abide by and convey the following rules to all class/workshop participants.

Food and Drink:

Food and beverages **are prohibited** in the auditorium and laboratories.

Messages:

Telephone messages for students and visitors are posted on the bulletin board just off the lobby. Messages will **not** be delivered to the classroom except in the event of an emergency.

Operating Hours:

The Center operates between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday. If you wish to use the facility beyond these hours, its use must be coordinated prior to the activity through Mrs. Jeanna Sissom, Administrator or Mr. Brent Ogles, Director.

Smoking:

Tobacco use is no longer allowed inside state buildings. Please smoke outside, at least 50 feet away from the door.

Telephones:

ALL long distance calls must be made collect or charged to a calling card. There is a telephone located in the large break room that can be used. Nashville is a local call from Murfreesboro.

Parking:

In the event that we are hosting several groups or large groups, parking may be limited. If spaces in our lot are unavailable, please park in the lot next door, just past FTC. That lot is specifically for overflow. **Do not park on the street, along the edges of the parking lot, next to the sidewalk, or in any other area where spaces are not marked.**

SCHEDULE CROSS CONNECTION TRAINING (BASIC 2103)

Day 1

I. INTRODUCTION
II. PURPOSE AND SCOPE
    A. Hazards/Case Histories
        1. Local incidents
        2. Foundation Slides

III. HYDRAULIC AND BACKFLOW PRINCIPLES
    I. Detailed discussion of RP internal parts and pressures

Day 2

IV. TEST PROCEDURES
    A. Reduced Pressure Assembly (RP)
        1. Procedure Review
        2. Test procedure video
        3. Practice
        4. Lunch
        5. Video – Repair (Watts Backflow Prevention- Maintenance & Repair 009, 007 [3/4" – 2"])
        6. Practice

Day 3

    B. Double Check Valve Assembly (DCVA)
        1. Procedure Review
        2. Test procedure video
        3. Test Report Review
        4. Practice
        5. Lunch
        6. Miscellaneous Classroom Lecture
            a. Authority
            b. Strainers
            c. Thermal expansion
            d. Enclosures
        7. Approved assemblies
        8. Practice
        9. Review for Exams

V. REPORTING
VI. PRACTICE

Day 4

V. EXAMS
A. Class Evaluation
B. Written Exam
C. Practical Exam

SCHEDULE CROSS CONNECTION TRAINING (RENEWAL 3102)

Day 1

I. Practice until 1:00 p.m.

II. Classroom Discussion
   a. Test Report
   b. New Regs, Laws, Policies
   c. Approved List
   d. Pressure Vacuum Breaker Procedure
   e. Review for Exam

Day 2

III. Exam
   a. Class Evaluation
   b. Practical Exam

Slide 1

The Essentials of Cross-Connection Control

Slide 2

Outline

Hydraulic Review
Definitions
Backflow Preventers
Applications
Summary

Slide 3

Water pressure will equalize across a pipe.

Water pressure flows from high pressure to low pressure regions.

Slide 4

Flow across a check valve will result in a pressure drop.

This pressure drop is due to friction and energy reduction as water flow across the check valve.

Pressure drop across a check valve as water is flowing pipe can be referred to as “differential” pressure drop.

Slide 5

When water flow ceases across check valve, the valve closes.

High pressure on supply side of valve will attempt to equalize across the valve to the downstream side

The check valve will close before pressure equalizes on both sides of the check valve. The resulting pressure drop is referred to as the static pressure drop across the check valve. All pressure drops across check valves determined from the test procedures will be static pressure drops.

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27 ¾” inches of water generates a pressure of one pound per square inch (psi)

27 ¾” inches of water = 2.31 feet of head

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Picture of Normal Water Flow through Distribution

Minimum pressure in mainlines is 20 psi.

Slide 8

Picture of Broken hydrant and mainline pressure open to atmosphere.

Pressure flow from high to low regions.

Water reverses flow from home to mainline since pressure is higher at the home than at the mainline.

Slide 9

Definition:

Backflow: The undesirable reversal of flow of water or other substances into the potable water distribution supply

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Backflow Occurs Due to:

- Backpressure
- Backsiphonage

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Definition

Backpressure: Pressure in downstream piping greater than supply pressure.

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Picture of Backpressure

Slide 13

Picture of Check Valve

Pressure downstream is 55 psi, Supply pressure is 50 psi. Water pressure flows from High to Low regions.

Water would reverse flow if check valve was not present

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Definition

Backsiphonage: Subatmospheric Pressure in the Water System

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Picture of Backsiphonage

Slide 16

Picture of Check Valve

Pressure downstream is 5 psi, Supply pressure is – 10 psi. Water pressure flows from High to Low regions.

Water would reverse flow if check valve was not present

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Definition

Cross-Connection: An actual or potential connection between a potable water supply and any non-potable substance or source.

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Cross-Connections

Two types of Cross-Connections

- Direct
- Indirect

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Definition

Direct Cross-Connection: A direct cross-connection is a connection subject to backpressure or backsiphonage

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Diagram of a Direct Connection

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Definition

Indirect Cross-Connection: An indirect cross-connection is a connection that is subject to backsiphonage only

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Tank with Submerged Inlet

Subject to backsiphonage only

Indirect Cross-Connection

Slide 23

Tank with Low Inlet on Side

Subject to backpressure and backsiphonage

Direct Cross-Connection

Slide 24

Low Inlet on two tanks with one having a line below level of tank and the other having a line above level of tank

The tank with low inlet with line oriented below water level of tank is subject to backpressure or backsiphonage.

The tank with the low inlet with line oriented above the water level in the tank can only be subject to backsiphonage above the level of the water.

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The tank with low inlet with line oriented below water level of tank is a **direct cross-connection**.

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The tank with the low inlet with line oriented above the water level in the tank is an **indirect cross-connection**.

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Aspirator Effect

Aspirator Effect occurs because of two conditions:

- **High Velocity Flow**
- **Undersized Piping**

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Degree of Hazard

Two types of Hazards:

- **Non-Health Hazard**
- **Health Hazard**

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Pollutant

- Non-Health Hazard
- Low Hazard
- Will not cause illness or death

Slide 30

Contaminant

- Health Hazard
- High Hazard
- Causes illness or death

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Five Means of Preventing Backflow

- Air Gap Separation
- Reduced Pressure Principle Assembly
- Double Check Valve Assembly
- Pressure Vacuum Breaker/Spill-Resistant Vacuum Breaker
- Atmospheric Vacuum Breaker

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Approved Air Gap

Separation must be 2X the diameter of the pipe, but never less than 1 inch

The best *method* of backflow protection:

Limited uses, Disadvantages are:

- Pressure loss
- Disinfectant reduction because of turbulence

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Approved Air Gap Separation

Protects against the following:

- Backsiphonage
- Backpressure
- Contaminant
- Pollutant

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Summary Table for Backflow Prevention Methods and Assemblies

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Reduced Pressure Principle Assembly Diagram

Two check valves, two shutoff valves, 3-4 test cocks, and a relief valve

The best *assembly* for backflow protection. Also referred to as an RP.

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Reduced Pressure Principle Assembly Diagram

Second check valve fouled with backpressure. Relief valve opens.

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Appropriate condition to use an RP diagram

Chemical injection of contaminant into pipe. RP protects against backpressure.

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Premise Isolation Protection

Supply side of backflow preventer is protected, however cross-connections and backflow could occur downstream of the assembly.

Slide 39

Cross-Connection Diagram showing unprotected cross-connection.

Safety shower line may be vulnerable to backflow.

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Suggested protection of Shower Line.

Connect a protected line in front of backflow preventer instead of after backflow preventer

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Reduce Pressure Principle Detector Assembly

Used primarily to determine water theft on unmetered fire lines

Consists of larger RP assembly that has a meter bypass to record small water flows. The small water flows will go through bypass (up to 3 gpm) instead of larger unit. The bypass is protected by a smaller RP assembly. In case of fire flows, water will flow through larger unit.

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Reduced Pressure Principle Assembly

Protects against:

- Backsiphonage
- Backpressure
- Contaminants
- Pollutants

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Summary Table for Backflow Prevention Methods and Assemblies

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Double Check Valve Assembly Diagram

Two check valves, two shutoff valves, 3-4 test cocks, **no** relief valve

Also referred to as a DC.

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Reduced Pressure Principle Assembly Diagram

Second check valve fouled with backpressure. The first check valve will protect.

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Double Check Detector Assembly

Used primarily to determine water theft on unmetered fire lines

Consists of larger DC assembly that has a meter bypass to record small water flows. The small water flows will go through bypass (up to 3 gpm) instead of larger unit. The bypass is protected by a smaller DC assembly. In case of fire flows, water will flow through larger unit.

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Double Check Valve Assembly

- Protects against:
- Backsiphonage
- Backpressure
- Pollutants *only*

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Summary Table for Backflow Prevention Methods and Assemblies

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Proper Installation for DC and RP (USC Recommendations)

- Minimum 12” above grade
- Maximum 36” above grade
- Accessibility for testing and repair
- Weather/vandalism protection (if needed) with adequate drainage

USC (University of Southern California)

The Foundation (The Foundation for Cross-Connection Control and Hydraulic Research)

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Proper Installation for DC and RP

Backflow Preventers should only be installed vertically, if they have been approved for vertical orientation.

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Pressure Vacuum Breaker

Pressure Vacuum Breaker or PVB is only used for internal protection and cannot be used for premises isolation on a water system’s distribution line.

The PVB consists of two shutoff valves, an air inlet valve, and a single check valve. The PVB is also known as point of use device and is used to protect as particular location rather than an entire premises.

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Pressure Vacuum Breaker

PVB will protect against backsiphonage only. The air inlet valve allows air to enter the chamber of the device breaking the vacuum condition. The single check valve is not adequate protection against backpressure.

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Pressure Vacuum Breaker Installation Requirements

PVBs must be installed a minimum of 12 inches above the highest point downstream of the assembly

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Pressure Vacuum Breaker Acceptable Use:

For internal protection, a PVB may be used with an aspirator which is subject to backsiphonage only.

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Pressure Vacuum Breaker Unacceptable Uses:

PVBs may not be used for situations that create backpressure such as pump injection of chemicals into a line.

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Pressure Vacuum Breaker

- Protects internally against:
- Backsiphonage
- Contaminant
- Pollutant
- Will not protect against backpressure

Must be at least 12 inches higher than the highest point downstream.

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Summary Table for Backflow Prevention Methods and Assemblies

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Atmospheric Vacuum Breaker

Atmospheric Vacuum Breaker or AVB is only used for internal protection and cannot be used for premises isolation on a water system's distribution line.

The AVB consists of a float check that acts as a check valve and an air inlet valve.

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Atmospheric Vacuum Breaker

AVB will protect against backsiphonage only. The air inlet valve allows air to enter the chamber of the device, breaking the vacuum condition. The check valve position of the float check is not adequate protection against backpressure.

The AVB is also known as point of use device and is used to protect as particular location rather than an entire premises.

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Atmospheric Vacuum Breaker Installation Requirements

AVBs must be installed a minimum of 6 inches above the highest point downstream of the assembly

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Atmospheric Vacuum Breaker
Acceptable Use:

For internal protection, a AVB may be used with an aspirator which is subject to backsiphonage only.

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Atmospheric Vacuum Breaker
Installation Requirements:

- No shutoff valves downstream of assembly
- Non-Continuous Use

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Atmospheric Vacuum Breaker

Pressure Vacuum Breaker

- Protects internally against:
- Backsiphonage
- Contaminant
- Pollutant
- Will not protect against backpressure

Must be at least 6 inches higher than the highest point downstream.
Non-Continuous Use
No shutoff Valves downstream of device

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Summary Table for Backflow Prevention Methods and Assemblies

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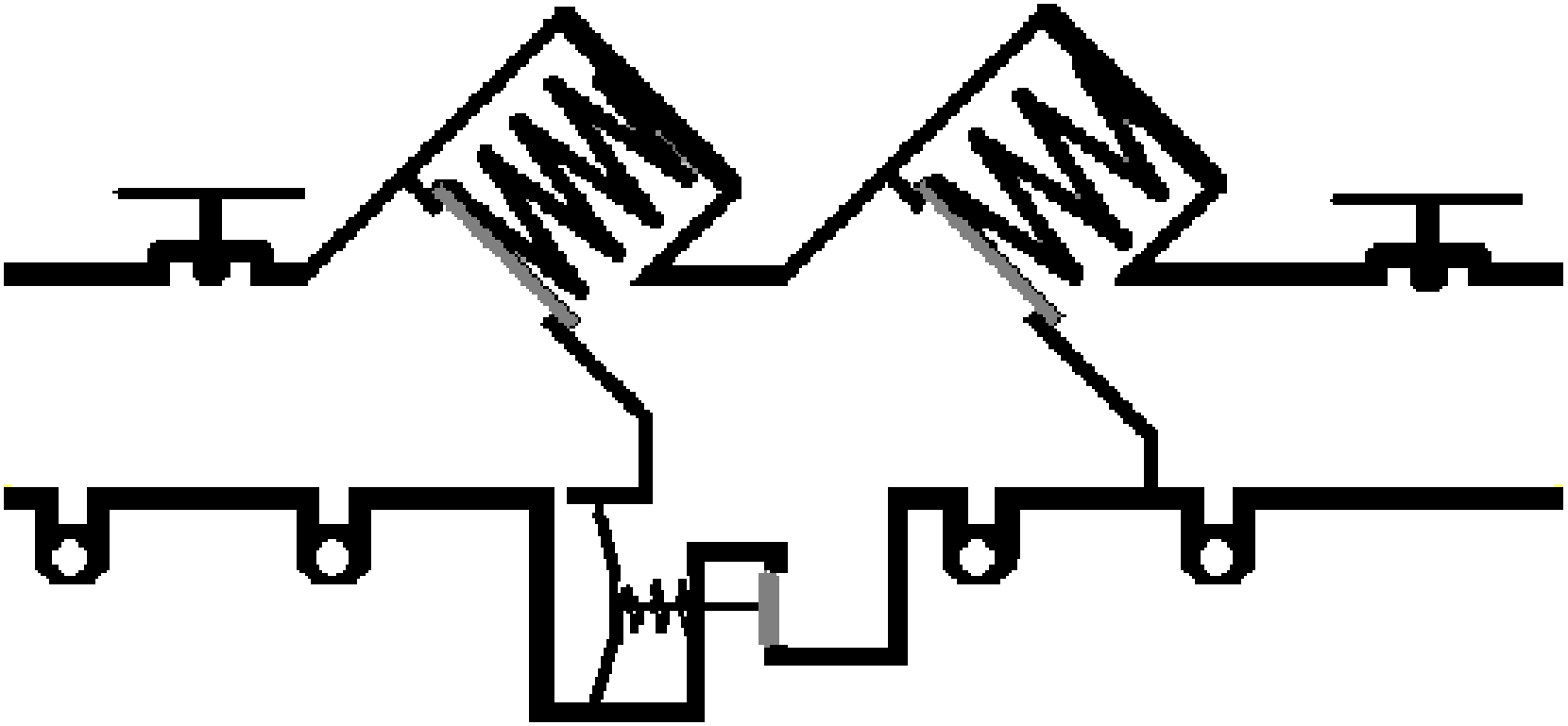
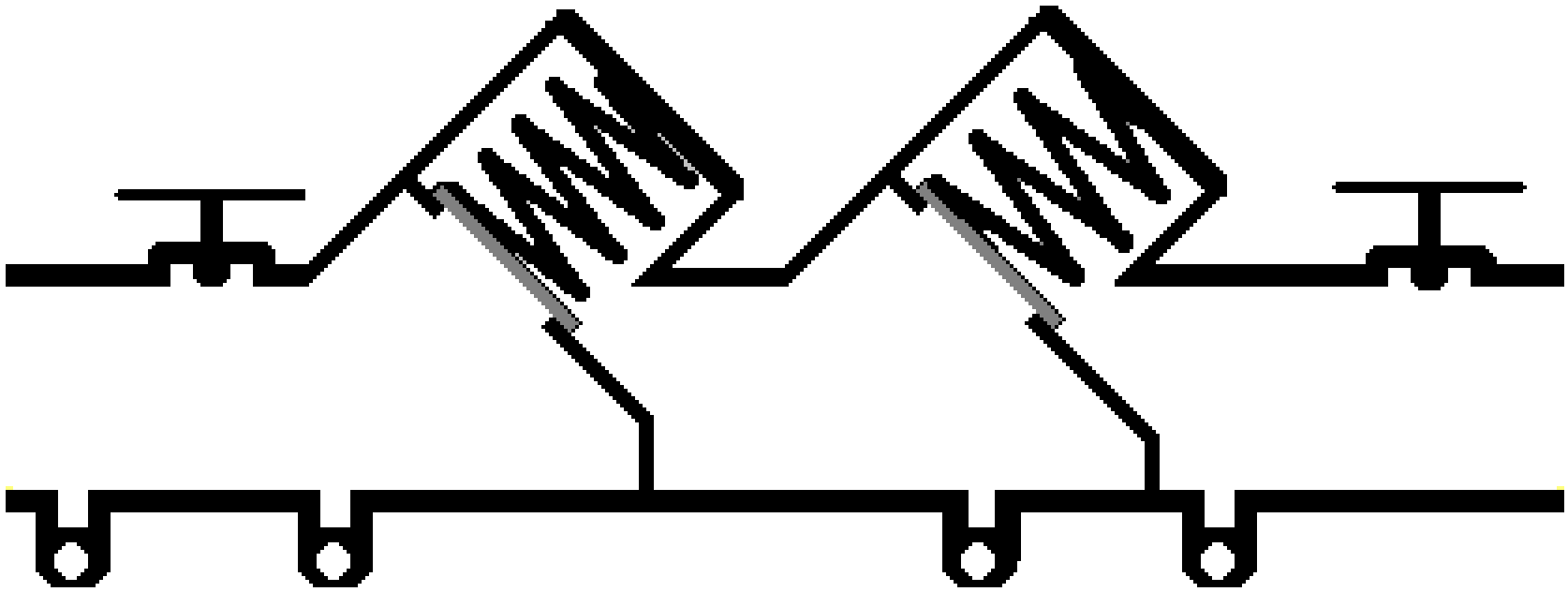
Summary

- Hydraulic Review
- Definitions
- Backflow Preventers
- Applications

RP Cutaway (closed)



DC Cutaway



Reduced Pressure Principle Assembly
5 Valve Procedure

A. Initial Setup

1. Flush test cocks by:
    a. Opening test cock #4 to establish flow through the unit. (Leave this test cock open until others are flushed)
    b. Open test cock #1, flush and close
    c. Open test cock #2, flush and close
    d. Open test cock #3, flush and close
    e. Close test cock #4
2. If not already in place, install test kit adapters into the test cocks
3. All test kit valves should be in CLOSED position before connecting the test kit
4. Connect high side hose of the test kit to test cock #2
5. Connect low side hose of the test kit to test cock #3
6. Open test cock #3
7. Open the low side bleed valve to purge air from the test kit.
8. Open test cock #2 **SLOWLY** (If this test cock is opened too quickly, it may cause the relief valve to open. To achieve accurate test measurements, it is important NOT to open the relief valve until the appropriate time)
9. Open the high side bleed valve to purge air from the test kit.
10. Close the high side bleed valve.
11. After the gauge reaches the upper end of the scale, close the low side bleed valve.
12. Close shutoff valve #2.
    a. If the relief valve begins to discharge when closing the shutoff valve, end the test at this point, complete the test report indicating a failed assembly and that check valve #1 is leaking.

Response:

Observe the gauge reading.

NOTE: The reading on the test kit reflects the APPARANT static drop across check valve #1 (setup pressure). DO NOT record this number at this time. This number cannot be correctly determined until other unit functions have been evaluated. The test kit and unit are now ready to begin the test.

- If the gauge stabilizes at point above the relief valve opening point, proceed to Section B.
- If the pressure drops to relief valve opening point, end the test at this point, complete the test report indicating a failed assembly.

B. Evaluate the Opening Point of the Relief Valve

Purpose: To determine that the relief valve is opening when the pressure in the zone is less than 2 psi of supply pressure and holding tight in other conditions.

1. Open the high side valve one turn.
2. Open the low side valve SLOWLY! Stop opening the valve when the gauge begins to drop. (The low side valve should not require opening more than one-quarter turn to exercise the relief valve. If it does require opening more than one-quarter turn, then it is possible that the shutoff valve #2 is leaking. Or, if the relief valve does not open, it may be stuck or the pressure passage may be clogged)
3. As the gauge drops, observe the relief valve discharge opening. When water begins to drip from the discharge opening, record the reading on the gauge. This reading is the relief valve opening point.
4. Close the low side valve.

Response:

- If the relief valve opened before the gauge drops to 2 psi, record the opening point on the test report and proceed to Section C.
- If the relief valve opened at a pressure less that 2 psi or did not open, end the test at this point, complete the test report indicating a failed assembly.

C. Test #2 Check For Leakage Against Backpressure

Purpose: To determine that check valve #2 is holding tight in backpressure conditions.

1. Open the bypass valve to purge air from the bypass line. Then close.
2. Connect the bypass hose to test cock #4, then open test cock #4.

3. Open low side bleed valve to reestablish setup pressure in the zone between the 2 checks. Then close low side bleed valve.
4. Open the bypass valve. (This will allow supply pressure to be routed to the zone between check valve #2 and shutoff valve #2).
5. Observe the gauge reading.
   a. No movement in the gauge indicates that check valve #2 is holding tight against backpressure.
   b. A slight drop in gauge pressure, then stability above the relief valve opening point, indicates check valve #2 disc compression. But the check valve is holding tight.
   c. A drop in gauge pressure to relief valve opening point indicates a leaking check valve #2. Reestablish set up pressure and evaluate again.

Response:

- If the check valve is holding tight, record this on the test report and proceed to Section D.
- If the check valve is NOT holding tight, end the test at this point, complete the test report indicating a failed assembly and a leaking check valve #2.

D. Evaluate the Drop Across #1 Check in Direction of Flow

Purpose: To determine that the static pressure drop across check valve #1 is 3 psi greater than the opening of the relief valve. (A reading less than 3 psi is does not mean that the unit is inadequate protection against backflow but does indicate that "spitting" may occur from the relief valve during line pressure fluctuations.)

1. Open the low side bleed valve to reestablish setup pressure in the zone.
2. Close the low side bleed valve.

Response:

- Observe the gauge reading.

a. A stable gauge pressure reading 3 psi above the relief valve opening point indicates that check valve one is holding tight with an adequate pressure differential to minimize spitting. Record this on the test report and proceed to Part E.

b. If the gauge pressure drops to relief valve opening point, end the test at this point, complete the test report indicating a failed assembly and a leaking check valve #1.

E. Test the #2 Shutoff Valve for Leakage

Purpose: To determine that shutoff valve #2 is holding tight.

1. Close test cock #2.

Response:

- No movement in the gauge indicates that shutoff valve #2 is holding tight. Record this on the test report.
- A drop in gauge pressure indicates that shutoff valve #2 is leaking. Record this on the test report, make the owner aware that repair MUST occur.

2. Close all test cocks. Disconnect all hoses. Close the high side and bypass valves. Proceed to Section F.

F. Evaluate the Drop Across #2 Check in Direction of Flow

Purpose: To determine that the pressure drop across check valve #2 is 1 psi or greater.

1. Connect high side hose of the test kit to test cock #3
2. Connect low side hose of the test kit to test cock #4
3. Open test cock #4
4. Open test cock #3
5. Open the low side bleed valve to purge air from the test kit.
6. Open the high side bleed valve to purge air from the test kit.
7. Close the high side bleed valve.
8. Close the low side bleed valve.

Response:

- Observe the gauge reading.

a. A stable gauge pressure reading 1 psi or above indicates that check valve #2 is holding tight with and adequate pressure differential. Record this on the test report form.

b. If the pressure drops below 1 psi, complete the test report indicating that repairs MUST be made to check valve #2.

9. Close all test cocks, disconnect all hoses, remove fittings and drain test kit, open shutoff valve #2.

Reduced Pressure Principle Assembly
3 Valve Procedure

A. Initial Setup

1. Flush test cocks by:
    a. Opening test cock #4 to establish flow through the unit. (Leave this test cock open until others are flushed)
    b. Open test cock #1, flush and close
    c. Open test cock #2, flush and close
    d. Open test cock #3, flush and close
    e. Close test cock #4
2. Install test kit adapters into the test cocks.
3. All test kit valves should be in CLOSED position before connecting the test kit
4. Connect high side hose of the test kit to test cock #2
5. Connect low side hose of the test kit to test cock #3
6. Open test cock #3
7. Open the low side valve and the bypass valve to purge air from the test kit.
8. Open test cock #2 **SLOWLY** (If this test cock is opened too quickly, it may cause the relief valve to open. To achieve accurate test measurements, it is important NOT to open the relief valve until the appropriate time)
9. Open the high side valve to purge air from the test kit.
10. Close the high side valve.
11. After the gauge reaches the upper end of the scale, close the low side valve and the bypass valve.
12. Close shutoff valve #2.
    a. If the relief valve begins to discharge when closing the shutoff valve, end the test at this point, complete the test report indicating a failed assembly and that check valve #1 is leaking.

Response:

Observe the gauge reading.

NOTE: The reading on the test kit reflects the APPARANT static drop across check valve #1 (setup pressure). DO NOT record this number at this time. This number cannot be correctly determined until other unit functions have been evaluated. The test kit and unit are now ready to begin the test.

- If the gauge stabilizes at point above the relief valve opening point, proceed to Section B.
- If the pressure drops to relief valve opening point, end the test at this point, complete the test report indicating a failed assembly.

B. Evaluate the Opening Point of the Relief Valve

Purpose: To determine that the relief valve is opening when the pressure in the zone is less than 2 psi of supply pressure and holding tight in other conditions.

1. Open the high side valve one turn.
2. Open the low side valve SLOWLY! Stop opening the valve when the gauge begins to drop. (The low side valve should not require opening more than one-quarter turn to exercise the relief valve. If it does require opening more than one-quarter turn, then it is possible that the shutoff valve #2 is leaking. Or, if the relief valve does not open, it may be stuck or the pressure passage may be clogged)
3. As the gauge drops, observe the relief valve discharge opening. When water begins to drip from the discharge opening, record the reading on the gauge. This reading is the relief valve opening point.
4. Close the low side valve.

Response:

- If the relief valve opened before the gauge drops to 2 psi, record the opening point on the test report and proceed to Section C.
- If the relief valve opened at a pressure less than 2 psi or did not open, end the test at this point, complete the test report indicating a failed assembly.

C. Test #2 Check For Leakage Against Backpressure

Purpose: To determine that check valve #2 is holding tight in backpressure conditions.

1. Open the bypass valve to purge air from the bypass line. Then close.
2. Connect the bypass hose to test cock #4, then open test cock #4.

3. Loosen the low side hose connection at test cock #3 allowing leakage to reestablish setup pressure in the zone between the two checks.
4. Tighten the low side hose connection.
5. Open the bypass valve. (This will allow supply pressure to be routed to the zone between check valve #2 and shutoff valve #2).
6. Observe the gauge reading.
   a. No movement in the gauge indicates that check valve #2 is holding tight against backpressure.
   b. A slight drop in gauge pressure, then stability above the relief valve opening point, indicates check valve #2 disc compression. But the check valve is holding tight.
   c. A drop in gauge pressure to relief valve opening point indicates a leaking check valve #2.

Response:

- If the check valve is holding tight, record this on the test report and proceed to Section D.
- If the check valve is NOT holding tight, end the test at this point, complete the test report indicating a failed assembly and a leaking check valve #2.

D. Evaluate the Drop Across #1 Check in Direction of Flow

Purpose: To determine that the static pressure drop across check valve #1 is 3 psi greater than the opening of the relief valve. (A reading less than 3 psi is does not mean that the unit is inadequate protection against backflow but does indicate that "spitting" may occur from the relief valve during line pressure fluctuations.)

1. Loosen the low side hose connection at test cock #3 allowing leakage to reestablish setup pressure in the zone between the two checks.
2. Tighten the low side hose connection.

Response:

- Observe the gauge reading.
   a. A stable gauge pressure reading 3 psi above the relief valve opening point indicates that check valve #1 is holding tight with an adequate pressure differential to minimize spitting. Record this on the test report and proceed to Part E.
   b. If the gauge pressure drops to relief valve opening point, end the test at this point, complete the test report indicating a failed assembly and a leaking check valve #1.

E. Test the #2 Shutoff Valve for Leakage

Purpose: To determine that shutoff valve #2 is holding tight.

1. Close test cock #2.

Response:

- No movement in the gauge indicates that shutoff valve #2 is holding tight. Record this on the test report.
- A drop in gauge pressure indicates that shutoff valve #2 is leaking. Record this on the test report, make the owner aware that repair MUST occur.

2. Close all test cocks. Disconnect all hoses. Close the high side and bypass valve. Proceed to Section F.

F. Evaluate the Drop Across #2 Check in Direction of Flow

Purpose: To determine that the pressure drop across check valve #2 is 1 psi or greater.

1. Connect high side hose of the test kit to test cock #3
2. Connect low side hose of the test kit to test cock #4
3. Open test cock #4
4. Open test cock #3
5. Open the low side valve and the bypass valve to purge air from the test kit.
6. Open the high side valve to purge air from the test kit.
7. Close the high side valve.
8. Close the low side valve and the bypass valve.

Response:

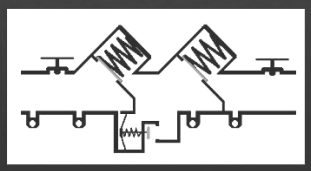
- Observe the gauge reading.
   a. A stable gauge pressure reading 1 psi or above indicates that check valve #2 is holding tight.
   b. If the pressure drops below 1 psi, complete the test report indicating that repairs MUST be made to check valve #2.

9. Close all test cocks, disconnect all hoses, open shutoff valve #2, remove fittings and drain test kit.

Test Procedure

Reduced Pressure Principle Assembly

TENNESSEE PROCEDURE
FOR TESTING
REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION DEVICES

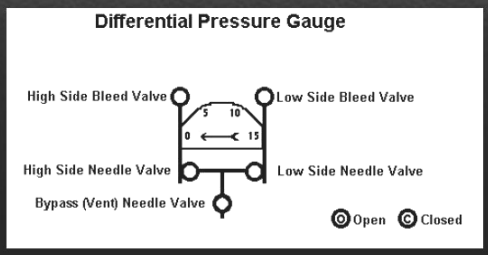


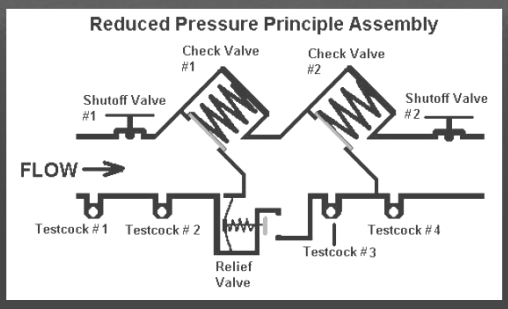
Five Valve Gauge

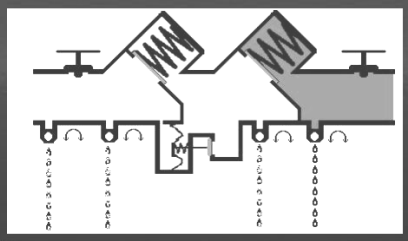
APRIL 1999

Test Kit
including a

Differential Pressure Gauge

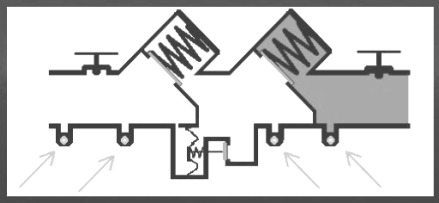




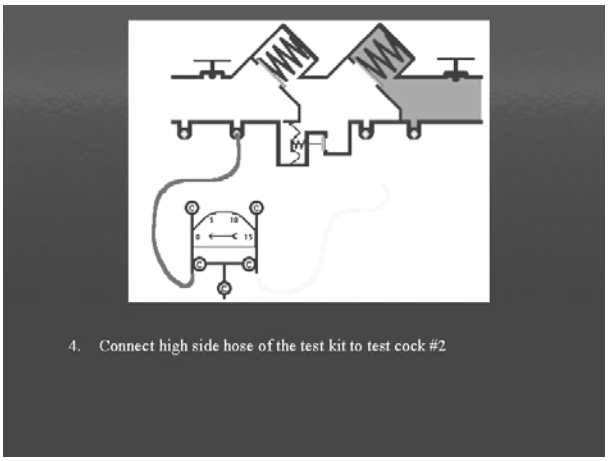


A. Initial Setup

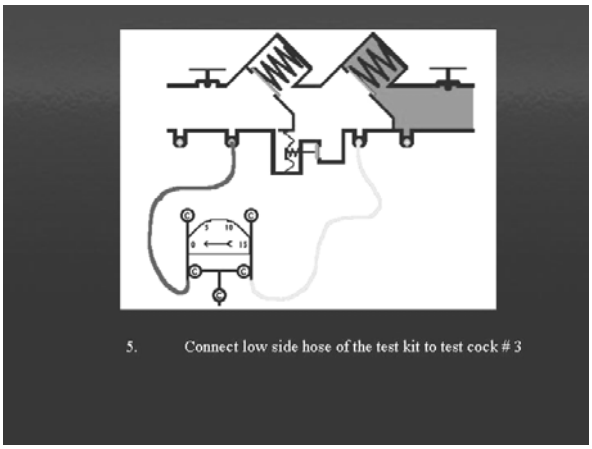
1. Flush test cocks by:
   a. opening test cock #4 to establish flow through the unit. (Leave this test cock open until others are flushed)
   b. open test cock #1, flush and close
   c. open test cock #2, flush and close
   d. open test cock #3, flush and close
   e. close test cock #4



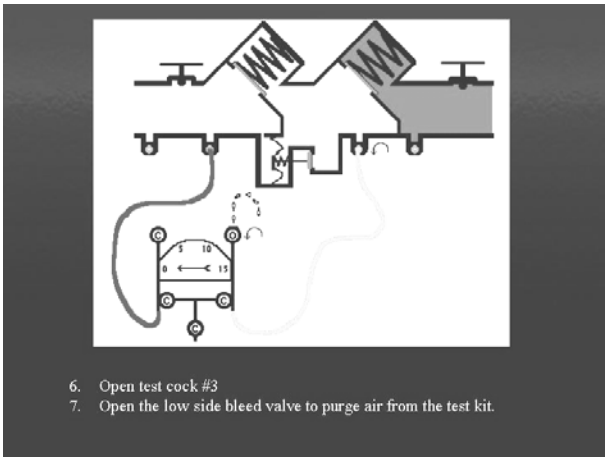
2. If not in place, install test kit adapters into the test cocks.
3. All test kit valves should be in CLOSED position before connecting the test kit



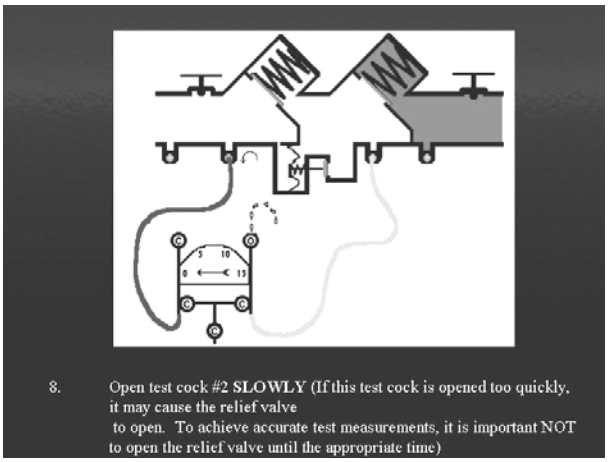
4. Connect high side hose of the test kit to test cock #2



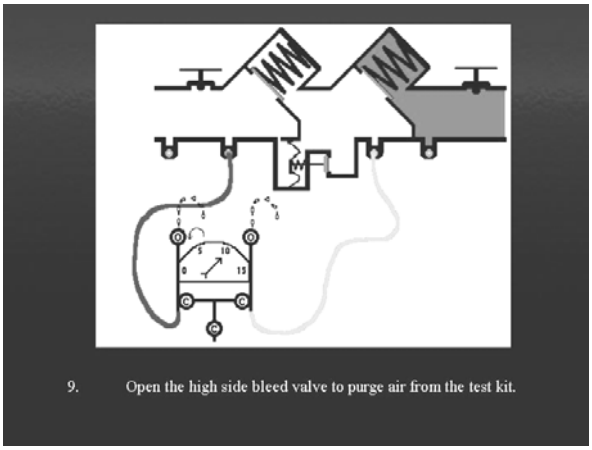
5. Connect low side hose of the test kit to test cock # 3



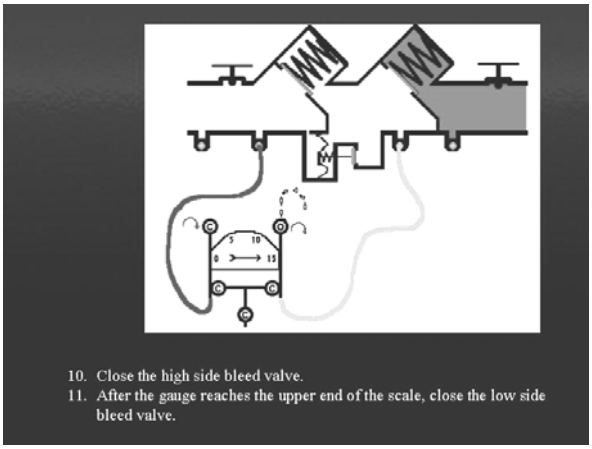
6. Open test cock #3
7. Open the low side bleed valve to purge air from the test kit.



8. Open test cock #2 **SLOWLY** (If this test cock is opened too quickly, it may cause the relief valve to open. To achieve accurate test measurements, it is important NOT to open the relief valve until the appropriate time)



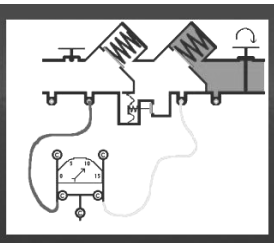
9. Open the high side bleed valve to purge air from the test kit.



10. Close the high side bleed valve.
11. After the gauge reaches the upper end of the scale, close the low side bleed valve.

12. Close shutoff valve #2.

a. If the relief valve begins to discharge when closing the shutoff valve, end the test at this point, complete the test report indicating a failed device and that check valve #1 is leaking.



Response:

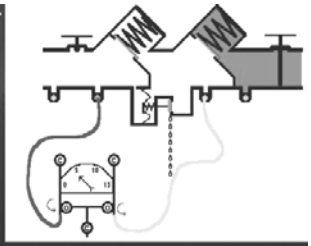
Observe the gauge reading.

NOTE: The reading on the test kit reflects the APPARANT static drop across check valve #1 (setup pressure). DO NOT record this number at this time. This number can not be correctly determined until other unit functions have been evaluated. The test kit and unit are now ready to begin the test.

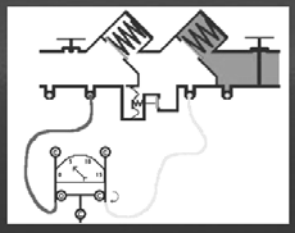
- If the gauge stabilizes at point above the relief valve opening point, proceed to Section B.
- If the pressure drops to relief valve opening point, end the test at this point, complete the test report indicating a failed device.

B. Evaluate the Opening Point of the Relief Valve

Purpose: To determine that the relief valve is opening when the pressure in the zone is less than 2 psi of supply pressure and holding tight in other conditions.



1. Open the high side valve one turn.
2. Open the low side valve SLOWLY! Stop opening the valve when the gauge begins to drop. (The low side valve should not require opening more than one-quarter turn to exercise the relief valve. If it does require opening more than one-quarter turn, then it is possible that the shutoff valve #2 is leaking. Or, if the relief valve does not open, it may be stuck or the pressure passage may be clogged)
3. As the gauge drops, observe the relief valve discharge opening. When water begins to drip from the discharge opening, record the reading on the gauge. This reading is the relief valve opening point.



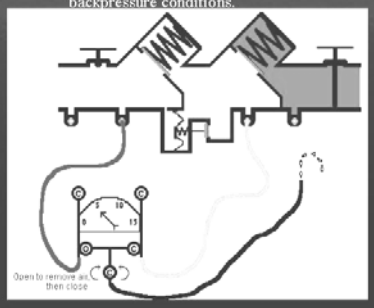
4. Close the low side valve.

Response:

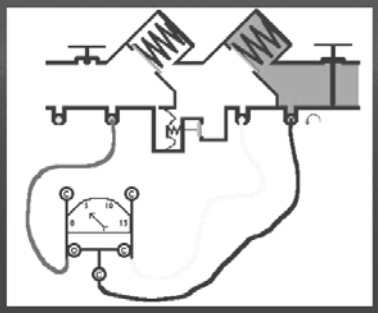
- If the relief valve opened before the gauge drops below 2 psi, record the opening point on the test report and proceed to Section C.
- If the relief valve opened at a pressure less than 2 psi or did not open, end the test at this point, complete the test report indicating a failed device.

C. Test #2 Check For Leakage Against Backpressure

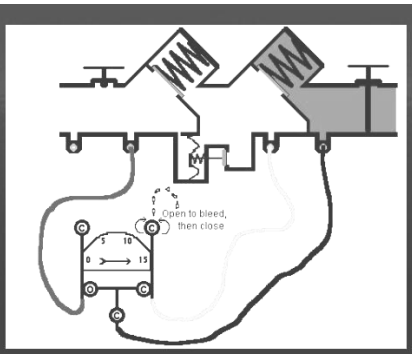
Purpose: To determine that check valve #2 is holding tight in backpressure conditions.



1. Open the bypass valve to purge air from the bypass line. Then close.



2. Connect the bypass hose to test cock #4, then open test cock #4.



3. Open low side bleed valve to reestablish setup pressure in the zone between the 2 checks. Then close low side bleed valve.

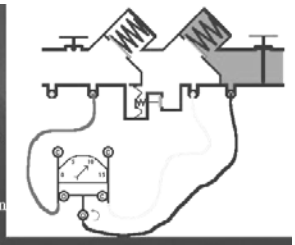
4. Open the bypass valve. (This will allow supply pressure to be routed to the zone between check valve #2 and shutoff valve #2).

5. Observe the gauge reading.

   a. No movement in the gauge indicates that check valve #2 is holding tight against backpressure.

   b. A slight drop in gauge pressure, then stability above the relief valve opening point, indicates check valve #2 disc compression. But the check valve is holding tight.

   c. A drop in gauge pressure to relief valve opening point indicates a leaking check valve #2. Reestablish setup pressure and evaluate again.

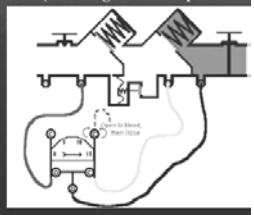


Response:

- If the check valve is holding tight, record this on the test report and proceed to Section D.
- If the check valve is NOT holding tight, end the test at this point, complete the test report indicating a failed device and a leaking check valve #2.

D. Evaluate the Drop Across #1 Check in Direction of Flow

Purpose: To determine that the static pressure drop across check valve #1 is 3 psi greater than the opening of the relief valve. (A reading less than 3 psi does not mean that the unit is inadequate protection against backflow but does indicate that "spitting" may occur from the relief valve during line pressure fluctuations.)



1. Open the low side bleed valve to reestablish setup pressure in the zone.

2. Close the low side bleed valve.

Response:

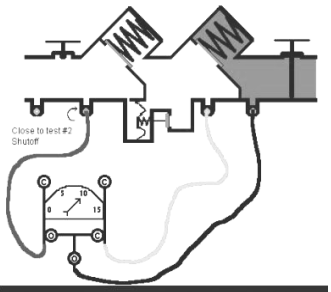
Observe the gauge reading.

a. A stable gauge pressure reading 3 psi above the relief valve opening point indicates that check valve one is holding tight with an adequate pressure differential to minimize spitting. Record this on the test report and proceed to Part E.

b. If the gauge pressure drops to relief valve opening point, end the test at this point, complete the test report indicating a failed device and a leaking check valve #1.

E. Test the #2 Shutoff Valve for Leakage

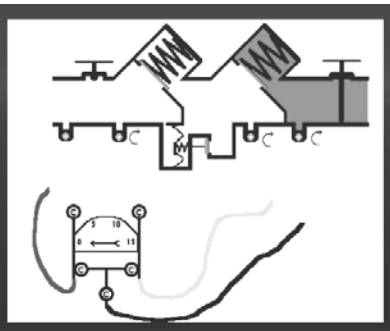
Purpose: To determine that shutoff valve #2 is holding tight.



1. Close test cock #2.

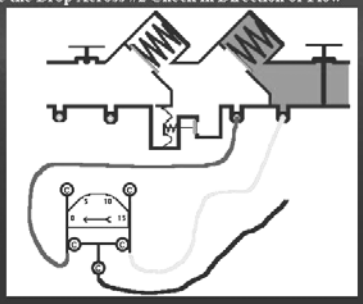
Response:

- No movement in the gauge indicates that shutoff valve #2 is holding tight record this on the test report.
- A drop in gauge pressure indicates that shutoff valve #2 is leaking record this on the test report, make the owner aware that repair MUST occur.



2. Close all test cocks. Disconnect all hoses. Close the high side and bypass valves. Proceed to Section F.

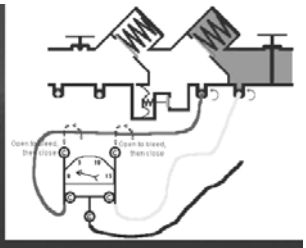
F. Evaluate the Drop Across #2 Check in Direction of Flow



Purpose: To determine that the pressure drop across check valve #2 is 1 psi or greater.

1. Connect high side hose of the test kit to test cock #3
2. Connect low side hose of the test kit to test cock #4

3. Open test cock #4
4. Open test cock #3
5. Open the low side bleed valve to purge air from the test kit.
6. Open the high side bleed valve to purge air from the test kit.
7. Close the high side bleed valve.
8. Close the low side bleed valve.

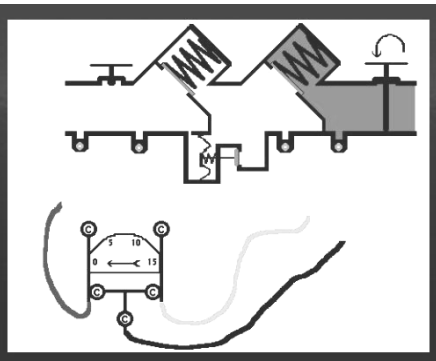


Response:•

Observe the gauge reading

a. A stable gauge pressure reading 1 psi or above indicates that check valve #2 is holding tight with an adequate pressure differential. Record this on the test report form.

b. If the pressure drops below 1 psi, complete the test report indicating that repairs MUST be made to check valve #2.



9. Close all test cocks, disconnect all hoses, remove fittings and drain test kit. Open shutoff valve #2.

Double Check Valve Assembly Test Procedure
5 Valve

A. Initial Setup

1. Flush test cocks by:
   a. Opening test cock #4 to establish flow through the unit. (Leave this test cock open until others are flushed)
   b. Open test cock #1, flush and close
   c. Open test cock #2, flush and close
   d. Open test cock #3, flush and close
   e. Close test cock #4
2. If not already in place, install test kit adapters into the test cocks
3. All test kit valves should be in CLOSED position before connecting the test kit
4. Connect high side hose of the test kit to test cock #2
5. Connect low side hose of the test kit to test cock #3
6. Open test cock #3
7. Open the low side bleed valve to purge air from the test kit
8. Open test cock #2
9. Open the high side bleed valve to purge air from the test kit
10. Close the high side bleed valve
11. After the gauge reaches the upper end of the scale, close the low side bleed valve. The reading on the gauge is the "setup pressure".
12. Close shutoff valve #2. The test kit and unit are now ready to begin the test

B. Evaluate the Drop Across #1 Check in Direction of Flow

Purpose: To determine that the static pressure drop across check valve #1 is 1 psi or greater.

1. Open the low side bleed valve to reestablish pressure in the zone between the checks.
2. Close the low side bleed valve.

Response:

- Observe the gauge reading.
  a. A stable gauge pressure reading 1 psi or greater indicates that check valve #1 is holding tight with an adequate pressure differential. Record this on the test report.
  b. If the gauge pressure drops below 1 psi, end the test at this point, complete the test report indicating a failed assembly.

C. Test #2 Check For Leakage Against Backpressure

Purpose: To determine that check valve #2 is holding tight in backpressure conditions.

1. Open the high side valve
2. Open the bypass valve to purge air from the bypass line. Then close.
3. Connect the bypass hose to test cock #4, then open test cock #4.
4. Open low side bleed valve to reestablish setup pressure in the zone between the two checks. Then close low side bleed valve.
5. Open the bypass valve. (This will allow supply pressure to be routed to the zone between check valve #2 and shutoff valve #2).
6. Observe the gauge reading.
   a. No movement in the gauge indicates that check valve #2 is holding tight against backpressure.

b. A slight drop in gauge pressure, then stability, indicates check valve #2 disc compression. But the check valve is holding tight.
c. A constant drop in gauge pressure to 0 psi indicates a leaking check valve #2.

Response:

- If the check valve is holding tight, record this on the test report and proceed to Section D.
- If the check valve is NOT holding tight, end the test at this point, complete the test report indicating a failed assembly and a leaking check valve #2.

D. Test the #2 Shutoff Valve for Leakage

Purpose: To determine that shutoff valve #2 is holding tight.

1. Close test cock #2.
   a. No movement in the gauge indicates that shutoff valve #2 is holding tight.
   b. A drop in gauge pressure indicates that shutoff valve #2 is leaking.

Response:

- If the shutoff valve holds tight, record this on the test report.
- If the shutoff valve leaks, record this on the test report, make the owner aware that repair MUST occur.

2. Close all test cocks, disconnect all hoses, close all test kit valves.

E. Evaluate the Drop Across #2 Check in Direction of Flow

Purpose: To determine that the pressure drop across check valve #2 is 1 psi or greater.

1. Connect high side hose of the test kit to test cock #3
2. Connect low side hose of the test kit to test cock #4
3. Open test cock #4
4. Open test cock #3
5. Open the low side bleed valve to purge air from the test kit.
6. Open the high side bleed valve to purge air from the test kit.
7. Close the high side bleed valve.
8. Close the low side bleed valve.

Response:

- Observe the gauge reading.

a. A stable gauge pressure reading 1 psi or above indicates that check valve #2 is holding tight with an adequate pressure differential. Record this on the test report form.
b. If the pressure drops below 1 psi, complete the test report indicating that repairs MUST be made to check valve #2.

9. Open shutoff valve #2, close all test cocks, disconnect all hoses, remove fittings and drain test kit.

Double Check Valve Assembly Test Procedure
3 Valve Test Kit

A. Initial Setup

1. Flush test cocks by:
   a. Opening test cock #4 to establish flow through the unit. (Leave this test cock open until others are flushed)
   b. Open test cock #1, flush and close
   c. Open test cock #2, flush and close
   d. Open test cock #3, flush and close
   e. Close test cock #4
2. If not already in place, install test kit adapters into the test cocks
3. All test kit valves should be in CLOSED position before connecting the test kit
4. Connect high side hose of the test kit to test cock #2
5. Connect low side hose of the test kit to test cock #3
6. Open test cock #3
7. Open the low side valve and the bypass valve to purge air from the test kit
8. Open test cock #2
9. Open the high side valve to purge air from the test kit
10. Close the high side valve
11. After the gauge reaches the upper end of the scale, close the low side valve. The reading on the gauge is the "setup pressure".
12. Close shutoff valve #2. The test kit and unit are now ready to begin the test

B. Evaluate the Drop Across #1 Check in Direction of Flow

Purpose: To determine that the static pressure drop across check valve #1 is 1 psi or greater.

1. Open the low side valve to reestablish pressure in the zone between the checks.
2. Close the low side valve.

Response:

- Observe the gauge reading.
  a. A stable gauge pressure reading 1 psi or greater indicates that check valve #1 is holding tight with an adequate pressure differential. Record this on the test report.
  b. If the gauge pressure drops below 1 psi, end the test at this point, complete the test report indicating a failed assembly.

C. Test #2 Check For Leakage Against Backpressure

Purpose: To determine that check valve #2 is holding tight in backpressure conditions.

1. Open the high side valve to purge air from the bypass line. Then close.
2. Connect the bypass hose to test cock #4, then open test cock #4.
3. Loosen the low side hose connection at test cock #3 allowing leakage to reestablish setup pressure in the zone between the two checks.
4. Tighten the low side hose connection.
5. Open the high side valve. (This will allow supply pressure to be routed to the zone between check valve #2 and shutoff valve #2).
6. Observe the gauge reading.
   a. No movement in the gauge indicates that check valve #2 is holding tight against

backpressure.

b. A slight drop in gauge pressure, then stability, indicates check valve #2 disc compression. But the check valve is holding tight.

c. A constant drop in gauge pressure to 0 psi indicates a leaking check valve #2.

Response:

- If the check valve is holding tight, record this on the test report and proceed to Section D.
- If the check valve is NOT holding tight, end the test at this point, complete the test report indicating a failed assembly and a leaking check valve #2.

D. Test the #2 Shutoff Valve for Leakage

Purpose: To determine that shutoff valve #2 is holding tight.

1. Close test cock #2.
   a. No movement in the gauge indicates that shutoff valve #2 is holding tight.
   b. A drop in gauge pressure indicates that shutoff valve #2 is leaking.

Response:

- If the shutoff valve holds tight, record this on the test report.
- If the shutoff valve leaks, record this on the test report, make the owner aware that repair MUST occur.

2. Close all test cocks, disconnect all hoses, close all test kit valves.

E. Evaluate the Drop Across #2 Check in Direction of Flow

Purpose: To determine that the pressure drop across check valve #2 is 1 psi or greater.

1. Connect high side hose of the test kit to test cock #3
2. Connect low side hose of the test kit to test cock #4
3. Open test cock #4
4. Open test cock #3
5. Open the low side valve and the bypass valve to purge air from the test kit.
6. Open the high side valve to purge air from the test kit.
7. Close the high side valve.
8. Close the low side valve.

Response:

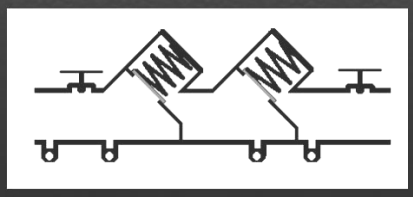
- Observe the gauge reading.
  a. A stable gauge pressure reading 1 psi or above indicates that check valve #2 is holding tight with an adequate pressure differential. Record this on the test report form.
  b. If the pressure drops below 1 psi, complete the test report indicating that repairs MUST be made to check valve #2.

9. Open shutoff valve #2, close all test cocks, disconnect all hoses, remove fittings and drain test kit.

Test Procedure

Double Check Valve Assembly

TENNESSEE PROCEDURE FOR TESTING
DOUBLE CHECK VALVE ASSEMBLY
BACKFLOW PREVENTION DEVICES



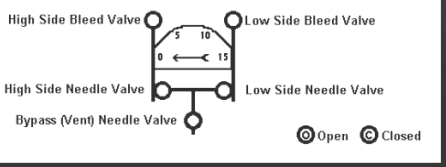
Five Valve Gauge

APRIL 1999

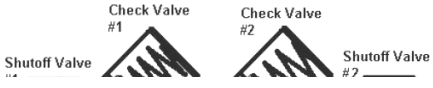
Test Kit

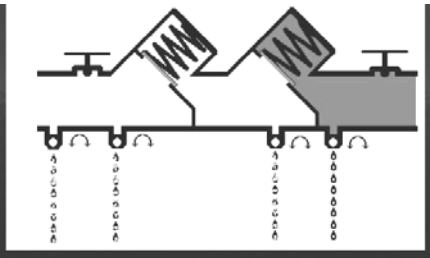
including a

Differential Pressure Gauge



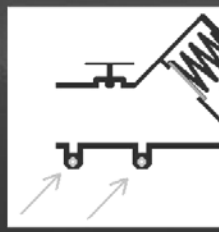
Double Check Valve Assembly



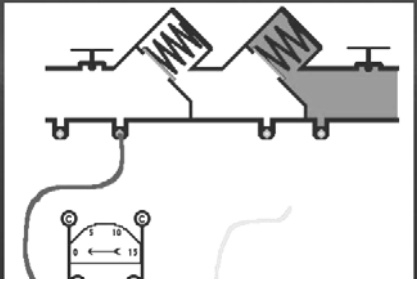


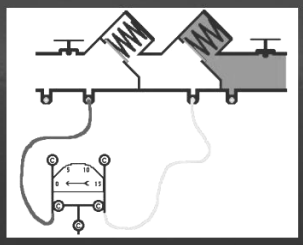
A. Initial Setup

1. Flush test cocks by:
   a. opening test cock #4 to establish flow through the unit. (Leave this test cock open until others are flushed)
   b. open test cock #1, flush and close
   c. open test cock #2, flush and close
   d. open test cock #3, flush and close
   e. close test cock #4

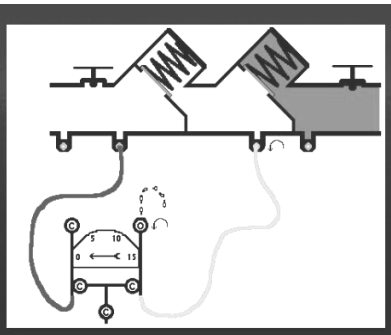


2. If not already in place, install test kit adapters into the test cocks.

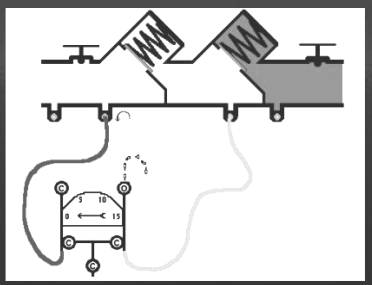




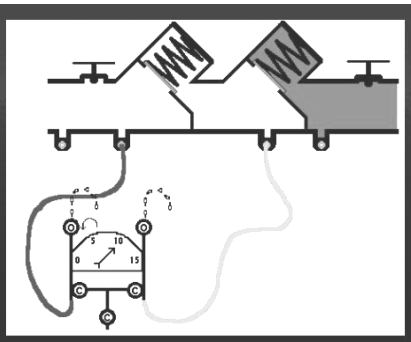
5. Connect low side hose of the test kit to test cock # 3



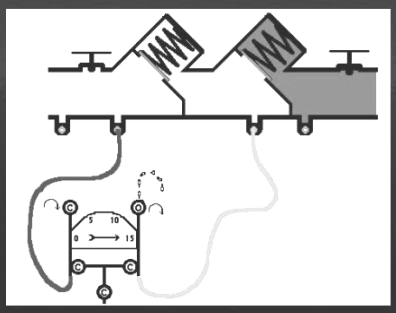
6. Open test cock # 3
7. Open the low side bleed valve to purge air from the test kit



8. Open test cock #2

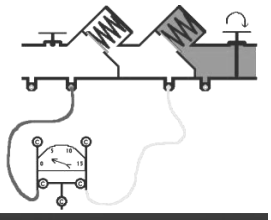


9. Open the high side bleed valve to purge air from the test kit



10. Close the high side bleed valve
11. After the gauge reaches the upper end of the scale, close the low side bleed valve. The reading on the gauge is the "setup pressure".

12. Close shutoff valve #2. The test kit and unit are now ready to begin the test



B. Evaluate the Drop Across #1 Check in Direction of Flow

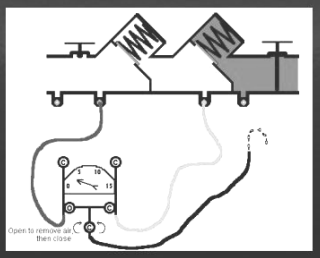
Purpose: To determine that the static pressure drop across check valve #1 is 1 psi or greater.

1. Open the low side bleed valve to reestablish pressure in the zone between the checks.
2. Close the low side bleed valve.

Response:

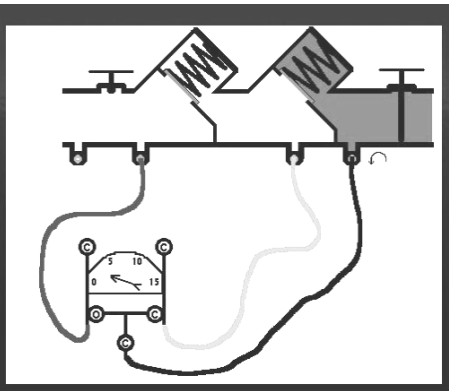
- Observe the gauge reading.
  a. A stable gauge pressure reading 1 psi or greater indicates that check valve one is holding tight with an adequate pressure differential. Record this on the test report.
  b. If the gauge pressure drops below 1 psi, end the test at this point, complete the test report indicating a failed device.

C. Test #2 Check For Leakage Against Backpressure

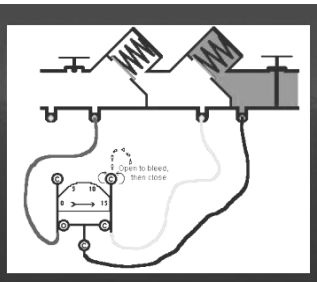


Purpose: To determine that check valve #2 is holding tight in backpressure conditions.

1. Open the high side valve
2. Open the bypass valve to purge air from the bypass line. Then close.



3. Connect the bypass hose to test cock #4, then open test cock # 4.



4. Open low side bleed valve to reestablish setup pressure in the zone between the 2 checks. Then close low side bleed valve.

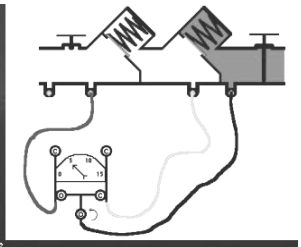
5. Open the bypass valve. (This will allow supply pressure to be routed to the zone between check valve #2 and shutoff valve #2).

6. Observe the gauge reading.

   a. No movement in the gauge indicates that check valve #2 is holding tight against backpressure.

   b. A slight drop in gauge pressure, then stability, indicates check valve #2 disc compression. But the check valve is holding tight.

   c. A constant drop in gauge pressure to 0 psi indicates a leaking check valve #2.



Response:

- If the check valve is holding tight, record this on the test report and proceed to Section D.
- If the check valve is NOT holding tight, end the test at this point, complete the test report indicating a failed device and a leaking check valve #2.

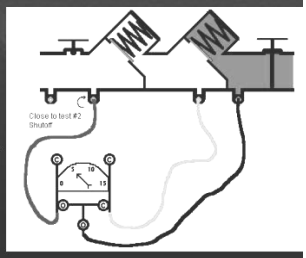
D. Test the #2 Shutoff Valve for Leakage

Purpose: To determine that shutoff valve #2 is holding tight.

1. Close test cock #2.

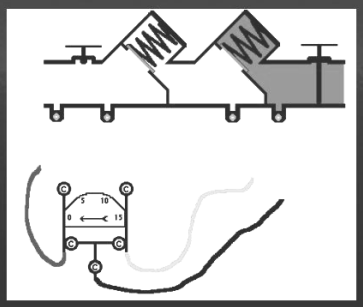
   a. No movement in the gauge indicates that shutoff valve #2 is holding tight.

   b. A drop in gauge pressure indicates that shutoff valve #2 is leaking.



Response:

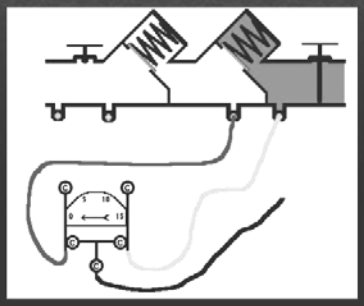
- If the shutoff valve holds tight, record this on the test report.
- If the shutoff valve leaks, record this on the test report, make the owner aware that repair MUST occur.



2. Close all test cocks, disconnect all hoses, close all test kit valves.

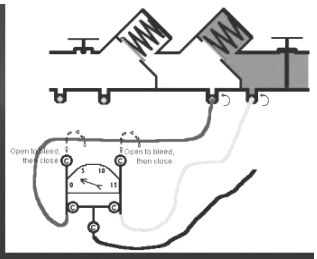
Evaluate the Drop Across #2 Check in Direction of Flow

Purpose: To determine that the pressure drop across check valve #2 is 1 psi. or greater.



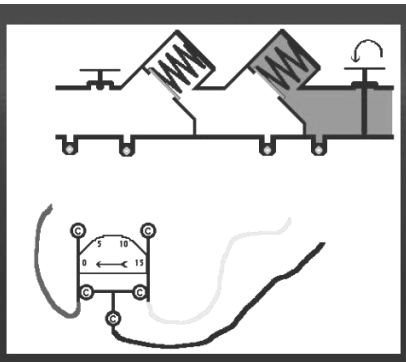
1. Connect high side hose of the test kit to test cock #3
2. Connect low side hose of the test kit to test cock #4

3. Open test cock #4
4. Open test cock #3
5. Open the low side bleed valve to purge air from the test kit.
6. Open the high side bleed valve to purge air from the test kit.
7. Close the high side bleed valve.
8. Close the low side bleed valve.



Response:

- Observe the gauge reading.
  a. A stable gauge pressure reading 1 psi or above indicates that check valve #2 is holding tight with an adequate pressure differential. Record this on the test report form.
  b. If the pressure drops below 1 psi, complete the test report indicating that repairs MUST be made to check valve #2.



9. Open shutoff valve #2, close all test cocks, disconnect all hoses, remove fittings and drain test kit.

BACKFLOW ASSEMBLY TEST REPORT

Service Address_____

Name of Premises_____ **Location of device**_____

Device_____ (Manufacturer) _____ (Model) _____ (Size) _____ (Serial Number)

Test Kit_____ (Manufacturer) _____ (Serial Number) _____ (Date Certified)

RP ☐
DC ☐
DCDA ☐
RPDA ☐

Reduced Pressure Principle Assembly				
Relief Valve Opening Point	**Check Valve # 2 Backpressure Test**	**Check Valve #1**	**No. 2 Shutoff Valve**	**Check Valve #2**
Opened at _____ psid Did not open ☐	Closed Tight ☐ Leaked ☐	Held at _____ psid Leaked ☐	Closed Tight ☐ Leaked ☐	Held at _____ psid Leaked ☐

Double Check Valve Assembly				**Backflow Assembly Status**
Check Valve #1	**Check Valve # 2 Backpressure Test**	**No. 2 Shutoff Valve**	**Check Valve #2**	
Held at _____ psid Leaked ☐	Closed Tight ☐ Leaked ☐	Closed Tight ☐ Leaked ☐	Held at _____ psid Leaked ☐	**Passed** ☐ **Failed** ☐

Date_____ Time_____ Certified Tester #_____

Test by (Signature)_____ Print Name_____

Your signature certifies that all information provided on this section is correct.

Comments:_____

BACKFLOW ASSEMBLY REPAIR REPORT

REPAIRS	**Cleaned** ☐ **Replaced**: (List all parts replaced**)** **List any additional repair items not previously addressed:**

Date_____ Time_____ Certified Tester #_____

Repair by (Signature)_____ Print Name_____

Your signature certifies that all information provided on this section is correct.

Reduced Pressure Principle Assembly				
Relief Valve Opening Point	**Check Valve # 2 Backpressure Test**	**Check Valve #1**	**No. 2 Shutoff Valve**	**Check Valve #2**
Opened at _____ psid Did not open ☐	Closed Tight ☐ Leaked ☐	Held at _____ psid Leaked ☐	Closed Tight ☐ Leaked ☐	Held at _____ psid Leaked ☐

Double Check Valve Assembly				**Backflow Assembly Status**
Check Valve #1	**Check Valve # 2 Backpressure Test**	**No. 2 Shutoff Valve**	**Check Valve #2**	
Held at _____ psid Leaked ☐	Closed Tight ☐ Leaked ☐	Closed Tight ☐ Leaked ☐	Held at _____ psid Leaked ☐	**Passed** ☐ **Failed** ☐

Date_____ Time_____ Certified Tester #_____

Test by (Signature)_____ Print Name_____

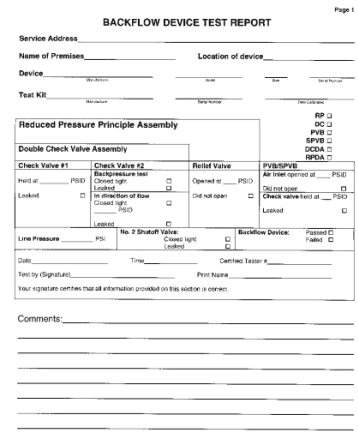
Your signature certifies that all information provided on this section is correct.

Comments:_____

_____

Test Report Slides

TEST REPORT



BACKFLOW DEVICE TEST REPORT

Service Address

Name of Premises — Location of device

Device

Test Kit

Reduced Pressure Principle Assembly

Double Check Valve Assembly

RP ☐
DC ☐
PVB ☐
SPVB ☐
DCDA ☐
RPDA ☐

Check Valve #1	Check Valve #2	Relief Valve	PVB/SPVB
Held at: _____ PSID	Backpressure test: Closed tight ☐ Leaked ☐	Opened at ____ PSID	Air Inlet opened at ____ PSID
Leaked ☐	In direction of flow: Closed tight ☐ _____ PSID Leaked ☐	Did not open ☐	Did not open ☐ Check valve held at ___ PSID Leaked ☐

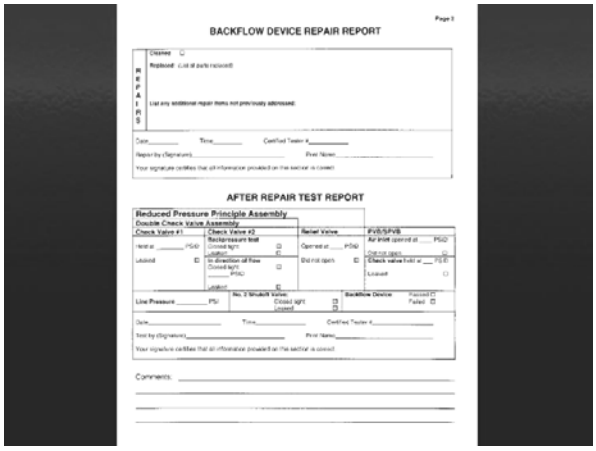
Line Pressure _____ PSI | No. 2 Shutoff Valve: Closed tight ☐ Leaked ☐ | Backflow Device: Passed ☐ Failed ☐

Date _____ Time _____ Certified Tester # _____

Test by (Signature) _____ Print Name _____

Your signature certifies that all information provided on this section is correct.

Comments: _____



BACKFLOW DEVICE REPAIR REPORT

REPAIRS

Cleaned ☐

Replaced: (List all parts replaced)

List any additional repair items not previously addressed:

Date _____ Time _____ Certified Tester # _____

Repair by (Signature) _____ Print Name _____

Your signature certifies that all information provided on this section is correct.

AFTER REPAIR TEST REPORT

Reduced Pressure Principle Assembly

Double Check Valve Assembly

Check Valve #1	Check Valve #2	Relief Valve	PVB/SPVB
Held at: _____ PSID	Backpressure test: Closed tight ☐ Leaked ☐	Opened at ____ PSID	Air Inlet opened at ____ PSID
Leaked ☐	In direction of flow: Closed tight ☐ _____ PSID Leaked ☐	Did not open ☐	Did not open ☐ Check valve held at ___ PSID Leaked ☐

Line Pressure _____ PSI | No. 2 Shutoff Valve: Closed tight ☐ Leaked ☐ | Backflow Device: Passed ☐ Failed ☐

Date _____ Time _____ Certified Tester # _____

Test by (Signature) _____ Print Name _____

Your signature certifies that all information provided on this section is correct.

Comments: _____

Authority

- State
  - Statute
  - Regulation
- Local
  - Ordinance (City) or Policy (Utility)
  - Plan

STATUTE

TCA 68-221-703. Definitions.

As used in this part, unless the context otherwise requires:

7) "Cross connection" means any physical arrangement whereby a public water supply is connected, directly or indirectly, with any other water supply system, sewer, drain, conduit, pool, storage reservoir, plumbing fixture or other device which contains, or may contain, contaminated water, sewage or other waste or liquid of unknown or unsafe quality which may be capable of imparting contamination to the public water supply as a result of backflow. Bypass arrangements, jumper connections, removable sections, swivel or change-over devices through which, or because of which, backflow could occur are considered to be cross-connections; [Acts 1983, ch. 324, § 4; 1988, ch. 583, § 2; T.C.A. § 68-13-703; Acts 1998, ch. 592, §§ 1-3.]

68-221-711. Prohibited acts.

The following acts are prohibited:

6) The installation, allowing the installation, or maintenance of any cross connection, auxiliary intake, or bypass, unless the source and quality of water from the auxiliary supply, the method of connection, and the use and operation of such cross connection, auxiliary intake, or bypass has been approved by the department; [Acts 1983, ch. 324, § 12; T.C.A., § 68-13-711.]

REGULATIONS
TO GOVERN PUBLIC WATER SYSTEMS

1200-5-1-.17 Operation and Maintenance Requirements

6) Pursuant to Section 68-221,711(6) the installation, allowing the installation, or maintenance of any cross-connection, auxiliary intake, or bypass is prohibited unless the source and quality of water from the auxiliary supply, the method of connection, and the use and operation of such cross-connection, auxiliary intake, or bypass has been approved by the Department. The arrangement of sewer, soil, or other drain lines or conduits carrying sewage or other wastes in such a manner that the sewage or waste may find its way into any part of the public water system is prohibited.

All community water systems must adopt an ordinance or policy prohibiting all of the above and submit a copy of the executed ordinance or policy to the Department for approval. All community water systems shall develop a written plan for a cross-connection control program to detect and eliminate or protect the system from cross-connections. The written plan must be approved by the Department.

After adoption and approval of the cross-connection ordinance or policy and plan, each community water system must establish an ongoing program for the detection and elimination of hazards associated with cross-connections. Records of the cross-connection control program must be maintained by the water supplier and shall include such items as date of inspection, person contacted, recommendations, follow-up, and testing results.

Example Ordinance or Policy (Excerpts)

(9) Testing of Devices. Devices shall be tested at least annually by a person possessing valid certification from the Tennessee Department of Environment and Conservation, Division of Drinking Water (or its successor) for the testing of such devices. Records of all tests shall be provided to the Murfreesboro Water and Sewer Department. Personnel of the Murfreesboro Water and Sewer Department shall have the right to inspect and test the devices whenever deemed necessary by the Director. Water service shall not be disrupted to test the device without the knowledge of the occupant of the premises.

Reduced Pressure Backflow Prevention devices shall be located a minimum of twelve (12") inches plus the nominal diameter of the device above the floor surface. Maximum height above the floor surface shall not exceed sixty (60") inches.

Clearance of device from wall surfaces or other obstructions shall be a minimum of six (6") inches.

Devices shall be protected from freezing, vandalism, mechanical abuse, and from any corrosive, sticky, greasy, abrasive, or other damaging environment.

Devices shall be positioned where discharge from relief port will not create undesirable conditions.

An approved air-gap shall separate the relief port from any drainage system.

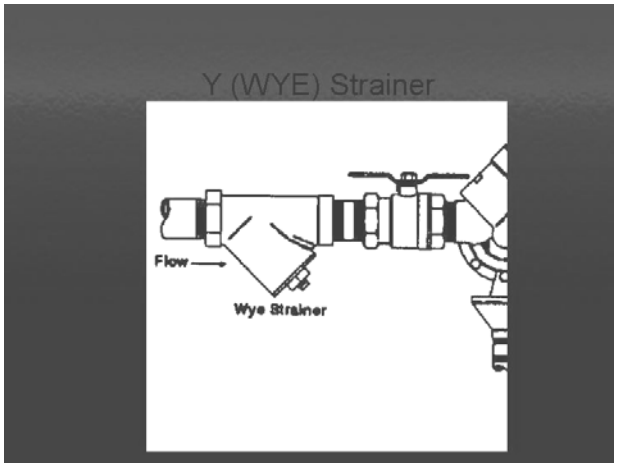
An approved strainer, fitted with a test cock, shall be installed immediately upstream of the backflow device or shut-off valve before strainer.

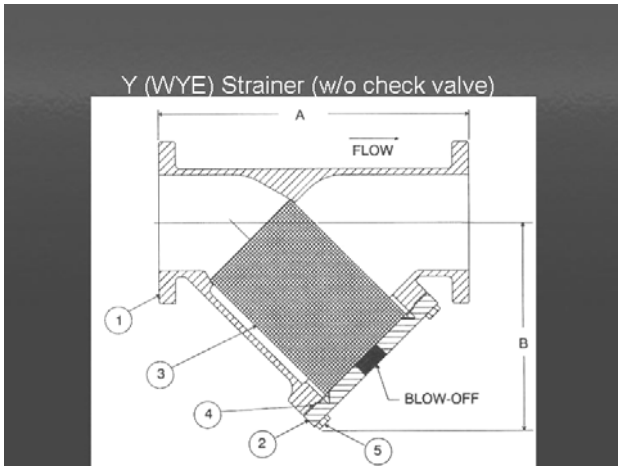
Devices shall be located in an area free from submergence or flood potential.

Penalty. Any person who neglects or refuses to comply with any of the provisions of this ordinance shall be deemed guilty of a misdemeanor, and subject to a fine of up to $500.00 on the first offense and $1,000.00 for each offense thereafter within any five (5) year period.

Independent of and in addition to fines and penalties, the Director may discontinue the public water supply service at any premises upon which there is found to be a cross connection, auxiliary intake, by-pass or interconnection, and service shall not be restored until such cross connection, auxiliary intake, by-pass or interconnection has been discontinued.

Protection of Backflow Prevention Devices

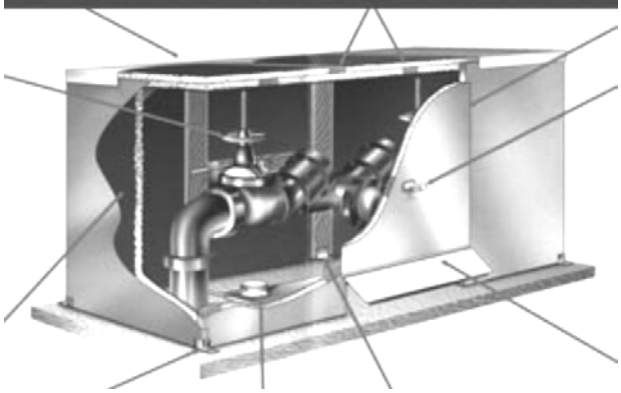

Y (WYE) Strainer
Flow
Wye Strainer

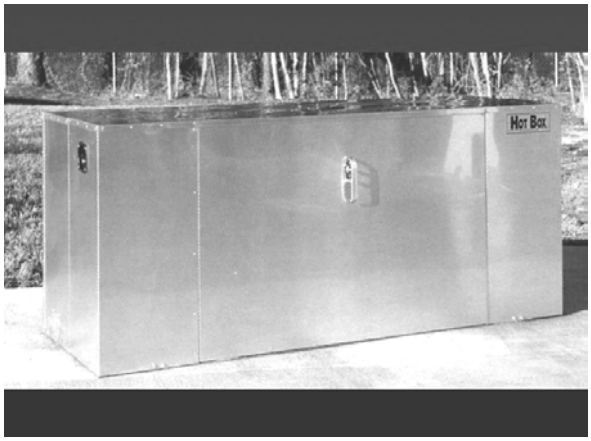

Y (WYE) Strainer (w/o check valve)
A
FLOW
B
1
3
4
2
5
BLOW-OFF

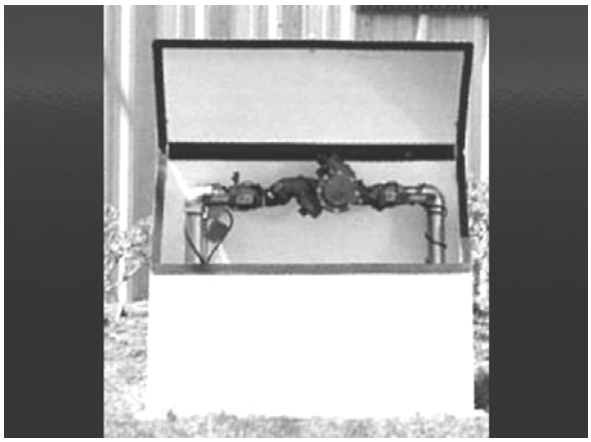

Is Protection Needed?

Enclosures

Enclosure







ASSE 1060

General Information

This standard focuses on devices that provide a range of protection to backflow preventers which are mounted outside and above ground so they may avoid freezing, vandalism and tampering.

It is recommended that enclosures be installed consistent with local codes by qualified and trained professionals.

This standard was promulgated in accordance with procedures developed by the American National Standards Institute (ANSI).

For a complete printed text please contact:

American Society of Sanitary Engineering for Plumbing and Sanitary Research

28901 Clemens Road, Suite # 100

Westlake, OH 44145

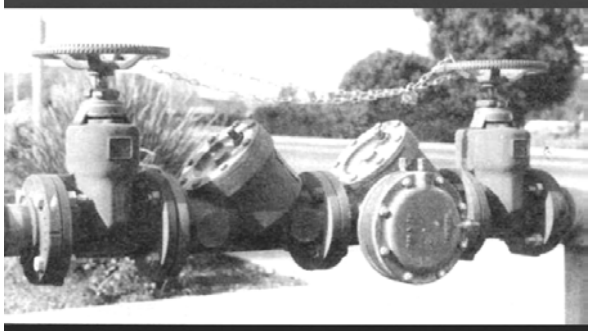
Telephone: (216) 835-3040

Facsimile: (216) 835-3488

E-Mail: ASSE@IX.netcom.com

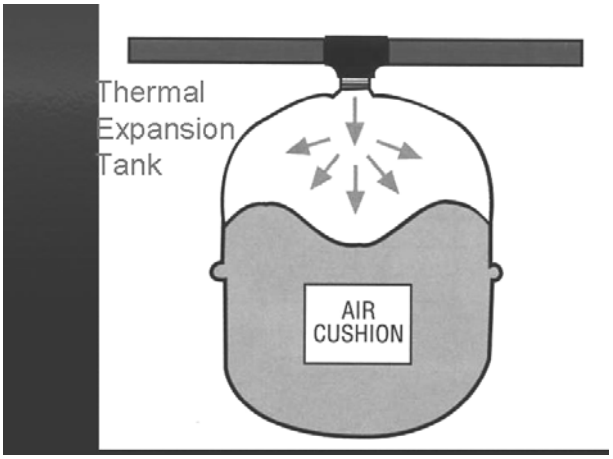
Protection: Remove Handles

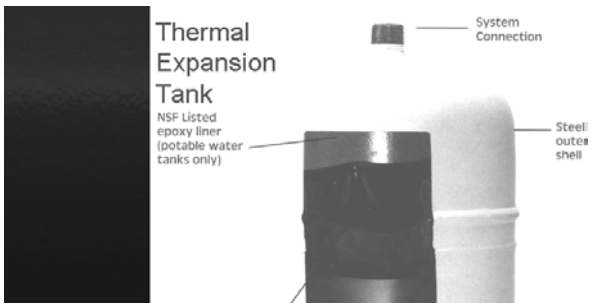
Protection: Chain Valves



Protection: Cages

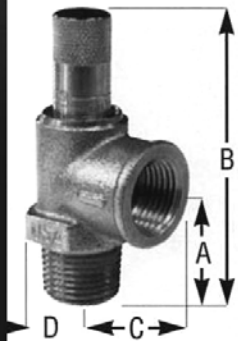
Thermal Expansion Issues

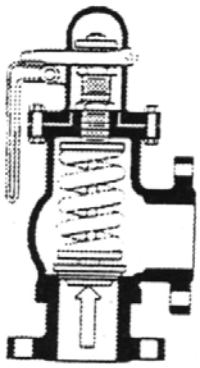




Ball Cock with Thermal Expansion Relief Port (Gov. 80)

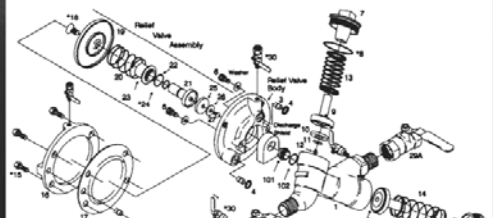
Calibrated Pressure Relief Valves





REPAIR

Model 825Y (3/4" - 2") Figure No. 11



The Foundation's Approval

The Foundation's Approval Program for backflow prevention assemblies is unique from other listing agencies. The Foundation has Laboratory ***and*** Field Evaluation.

Lab evaluation

- Hydrostatic Tests
- Pressure Loss Tests
- Pressure Drop Across Check Valves (evaluate for minimums)
- Thermal Loop (Run at rate temp and pressure for 100 hours.)
- Life Cycle Test (5000 cycles)

Field Evaluation

The Foundation's experience has been that the Laboratory Evaluation determines the general operating characteristics of the backflow prevention assembly under test, but the twelve-month Field Evaluation puts the assembly into actual field conditions. Many variables can be simulated and tested in the laboratory, but the effects of time in-use have not been successfully simulated in the lab.
A recent survey of the Foundation's field evaluation results showed that one third of those backflow preventers which passed the Laboratory Evaluation Phase of the Approval Program and were released to the Field Evaluation Phase did not pass the Field Evaluation the first time.

Approved List

- Updated on a regular basis
- Backflow Preventers installed must be on Approved List
- Installation of Device must be in correct orientation
- Spare parts must on list
- TN list is taken from the Foundation's List

Tennessee Approved List

Approved Backflow Prevention Assemblies
Tennessee Department of Environment and Conservation
Division of Water Supply
Date Revised:
August 15, 2006
Only units currently approved by the TN Division of Water Supply

Orientation of Assemblies
Febco 825 YA

Febco 825 YA
Orientation:
H = Horizontal

Febco 825 YA
Orientation:
VUVD = Vertical Up Inlet; Vertical Down Outlet

Febco 825 YA
Orientation:
VUH = Vertical Up Inlet; Horizontal Outlet

Febco 825 YA
Orientation:
HVD = Horizontal Inlet; Vertical Down Outlet

Tennessee Code Annotated 68-221-701 through 718

TCA 68-221-703. Definitions.

As used in this part, unless the context otherwise requires:

7) "Cross connection" means any physical arrangement whereby a public water supply is connected, directly or indirectly, with any other water supply system, sewer, drain, conduit, pool, storage reservoir, plumbing fixture or other device which contains, or may contain, contaminated water, sewage or other waste or liquid of unknown or unsafe quality which may be capable of imparting contamination to the public water supply as a result of backflow. Bypass arrangements, jumper connections, removable sections, swivel or change-over devices through which, or because of which, backflow could occur are considered to be cross-connections; [Acts 1983, ch. 324, § 4; 1988, ch. 583, § 2; T.C.A. § 68-13-703; Acts 1998, ch. 592, §§ 1-3.]

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The following acts are prohibited:

6) The installation, allowing the installation, or maintenance of any cross connection, auxiliary intake, or bypass, unless the source and quality of water from the auxiliary

supply, the method of connection, and the use and operation of such cross connection, auxiliary intake, or bypass has been approved by the department; [Acts 1983, ch. 324, § 12; T.C.A., § 68-13-711.]

1200-5-1-.17 Operation and Maintenance Requirements

6) Pursuant to Section 68-221,711(6) the installation, allowing the installation, or maintenance of any cross-connection, auxiliary intake, or bypass is prohibited unless the source and quality of water from the auxiliary supply, the method of connection, and the use and operation of such cross-connection, auxiliary intake, or bypass has been approved by the Department. The arrangement of sewer, soil, or other drain lines or conduits carrying sewage or other wastes in such a manner that the sewage or waste may find its way into any part of the public water system is prohibited.

   All community water systems must adopt an ordinance or policy prohibiting all of the above and submit a copy of the executed ordinance or policy to the Department for approval. All community water systems shall develop a written plan for a cross-connection control program to detect and eliminate or protect the system from cross-connections. The written plan must be approved by the Department.

   After adoption and approval of the cross-connection ordinance or policy and plan, each community water system must establish an ongoing program for the detection and elimination of hazards associated with cross-connections. Records of the cross-connection control program must be maintained by the water supplier and shall include such items as date of inspection, person contacted, recommendations, follow-up, and testing results.

RULES
OF
DEPARTMENT OF COMMERCE AND INSURANCE
DIVISION OF FIRE PREVENTION
CHAPTER 0780-2-7
FIRE PROTECTION SPRINKLER SYSTEM
CONTRACTORS

0780-2-7-.01 DEFINITIONS.

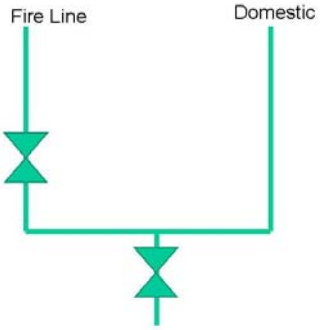
(g) "Point of Service" means the point immediately after the tap of the service main where water is used exclusively for fire protection purposes.

(i) "Service" means to repair, test, or inspect.

0780-2-7-.08 INSTALLATION, INSPECTION AND SERVICE.

(4) Inspection and service, where required, shall be conducted by a registered fire protection sprinkler system contractor in accordance with the standards. Written reports of inspections shall be completed and filed in accordance with paragraph (3) of this rule.

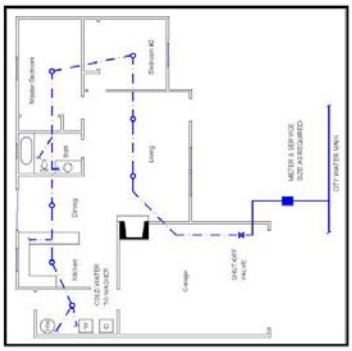
Which is Testable Without a Fire Sprinkler Contractor License?



Residential Fire Protection Systems

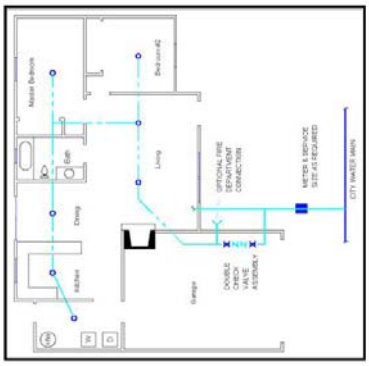
Residential Flow-Through Fire Protection

Residential Protection System



No Backflow Preventer required

Residential Closed Fire Protection System



Double Check Valve required at minimum

Who may install or repair backflow prevention assemblies?
Individuals that repair or install backflow prevention assemblies will have to comply with requirements set forth by the public water system. State statutes or regulations from various departments and division may also apply.

Is a plumbing license required for installation and repair of backflow prevention assembly?

The Department of Commerce and Insurance, Division of the Regulatory Boards defines plumbing work as follows:

"Plumbing work" means the construction, alteration, repair, improvement, movement, demolition, putting up, tearing down, or furnishing labor to install material or equipment within any residential or commercial building of all piping, fixtures, and appliances for the supply of gas, water, liquids or disposal of waste water or sewage; provided, **that there is no intent to require licensure under this part for plumbing work performed outside a residential or commercial building, including but not limited to utility connections or irrigation systems.**

If you have questions on whether a plumbing license is needed or not for assembly installation or repair, contact the following Division:
The Board for Licensing Contractors, which is a division of the Regulatory Boards within the Department of Commerce and Insurance.
Call
(615) 532-2868
or by email at:
Joe.Kraeske@state.tn.us or **Carolyn.Lazenby@state.tn.us**

RULES
OF
DEPARTMENT OF COMMERCE AND INSURANCE
DIVISION OF FIRE PREVENTION
CHAPTER 0780-2-7
FIRE PROTECTION SPRINKLER SYSTEM CONTRACTORS

0780-2-7-.01 DEFINITIONS.

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0780-2-7-08 INSTALLATION, INSPECTION AND SERVICE.

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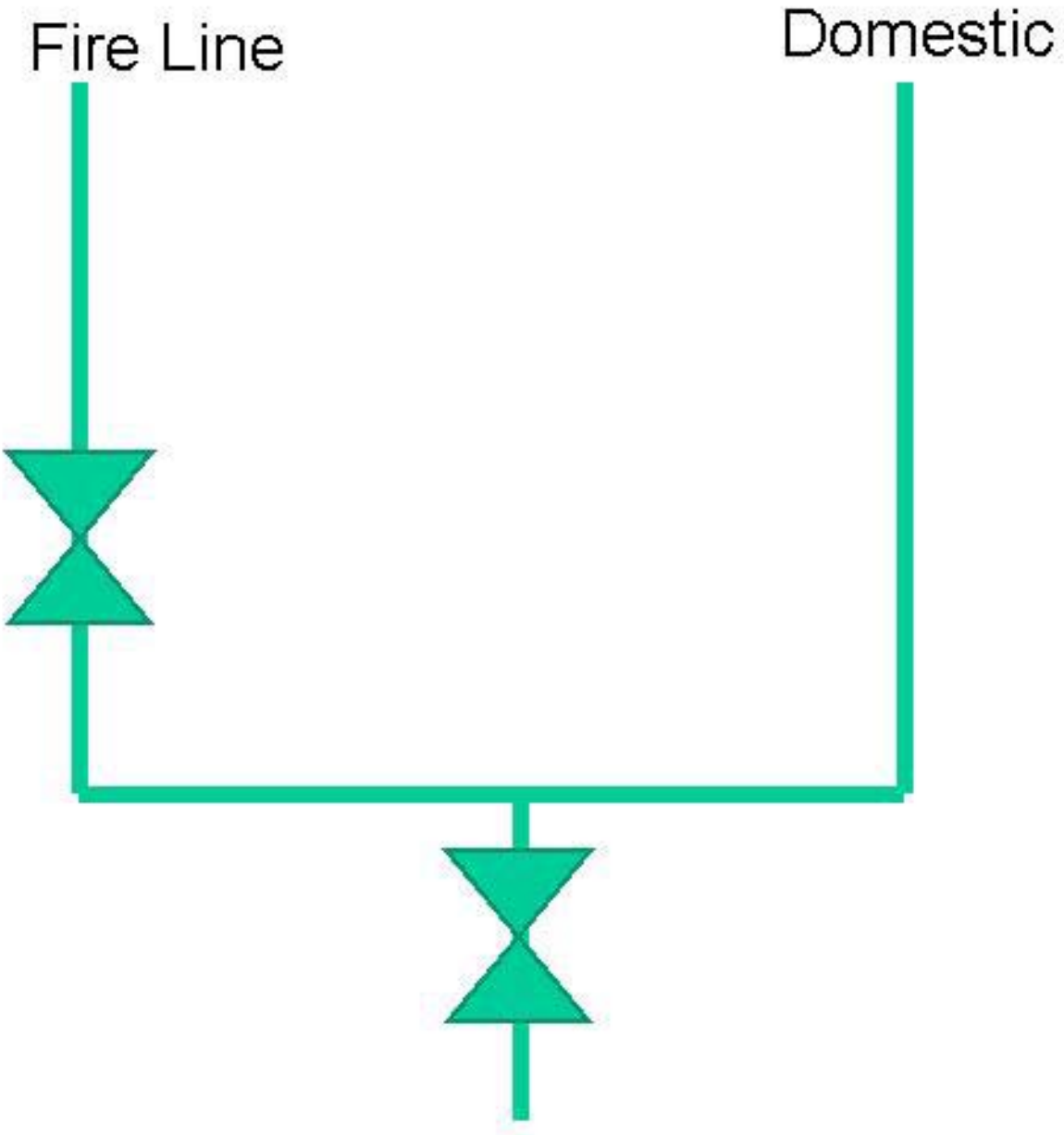
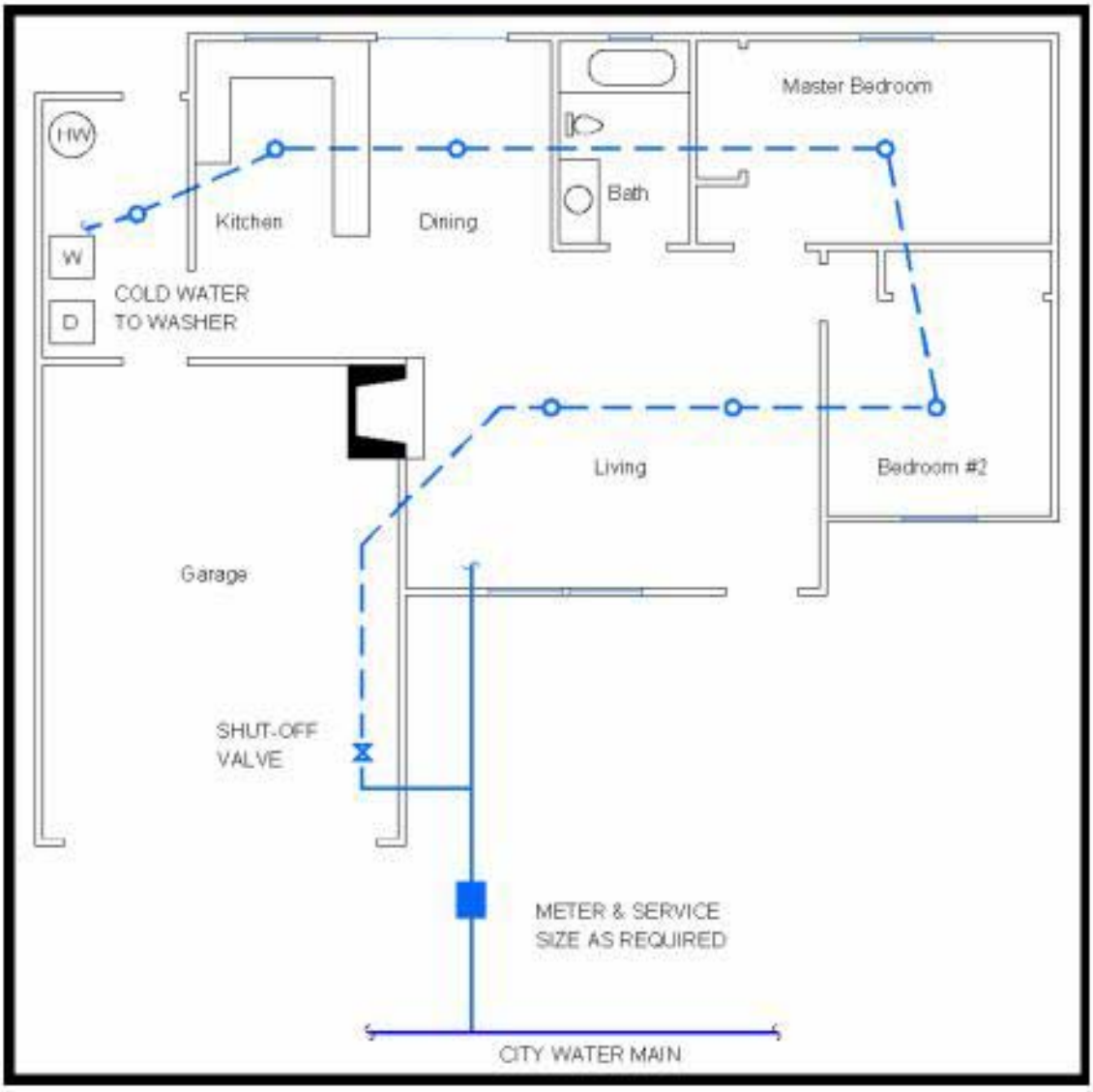
Which is Testable Without a Fire Sprinkler Contractor License?



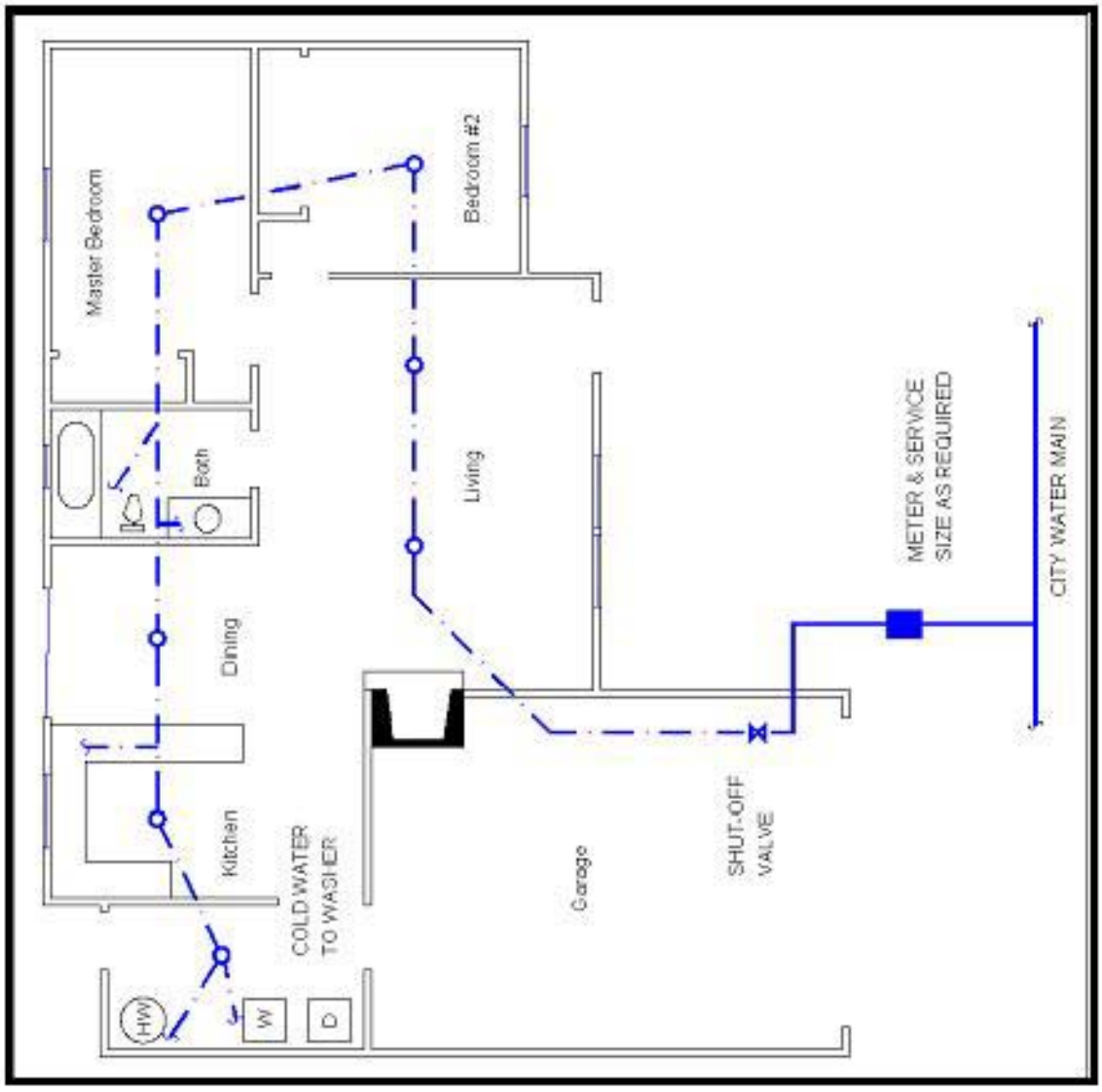
Residential Fire Protection Systems

Residential Flow-Through Fire Protection System



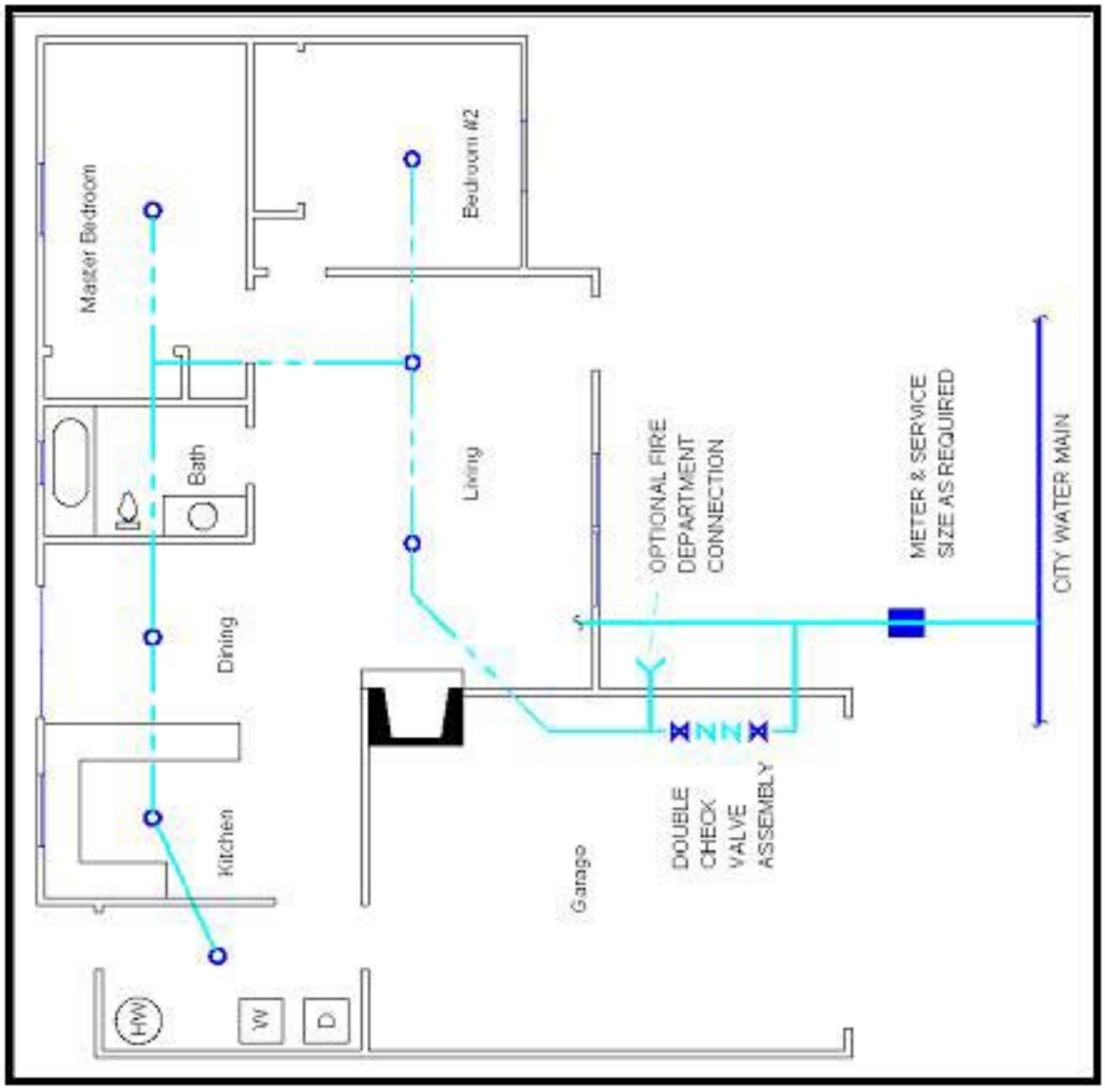
No Backflow Preventer required.

Residential Protection System



No Backflow Preventer required.

Residential Closed Fire Protection System



Double Check Valve required at minimum.

Who Can Install or Repair Backflow Prevention Assemblies?

Who may install or repair backflow prevention assemblies?
Individuals that repair or install backflow prevention assemblies will have to comply with requirements set forth by the public water system. State statutes or regulations from various departments and division may also apply.

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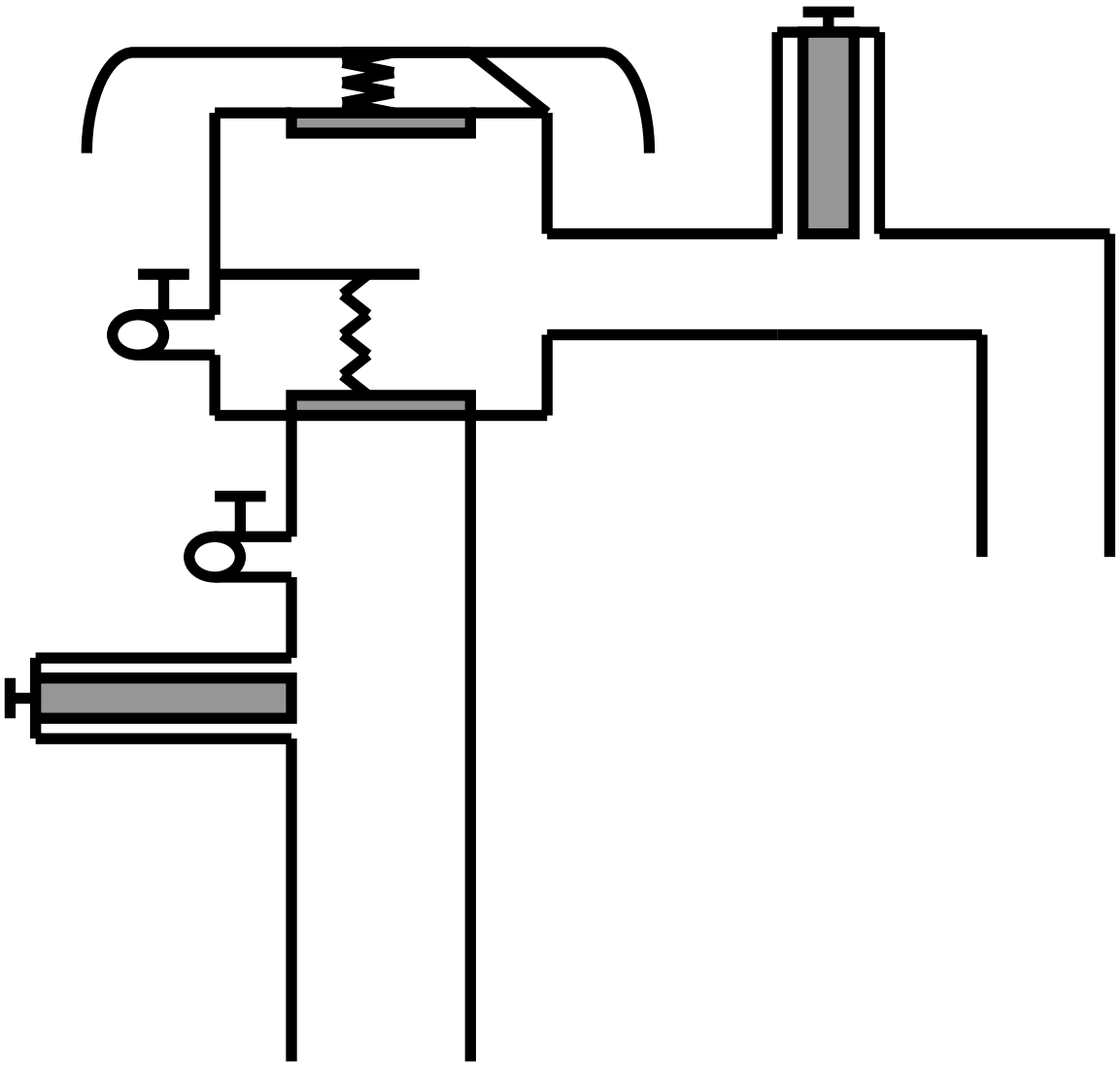
Call
(615) 532-2868
or by email at:
Joe.Kraeske@state.tn.us or **Carolyn.Lazenby@state.tn.us**

TENNESSEE PROCEDURE FOR TESTING

PRESSURE VACUUM BREAKER

BACKSIPHONAGE

PREVENTION DEVICES

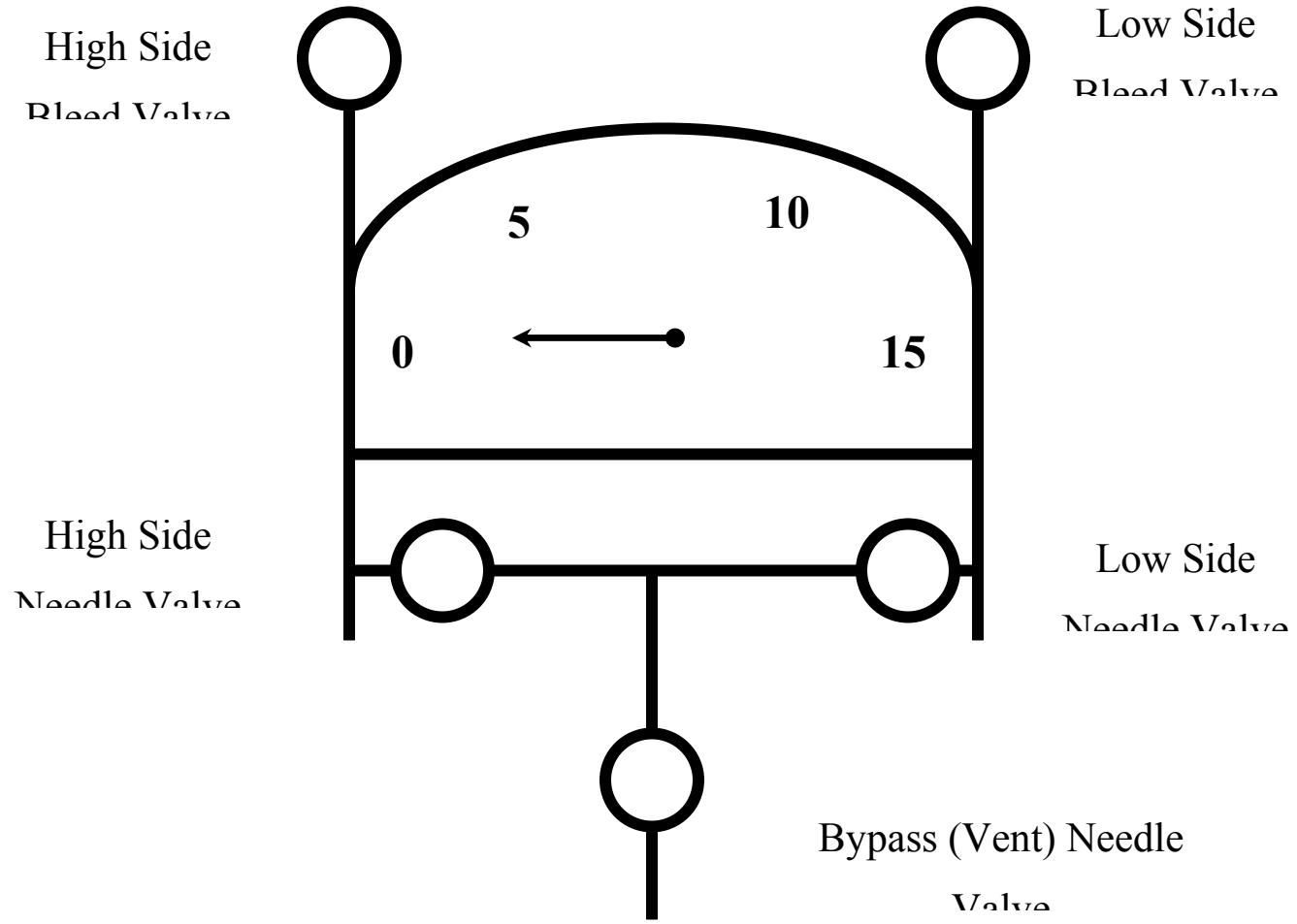


Five Valve Gauge
February 2004

A.Five Valve Test Kit

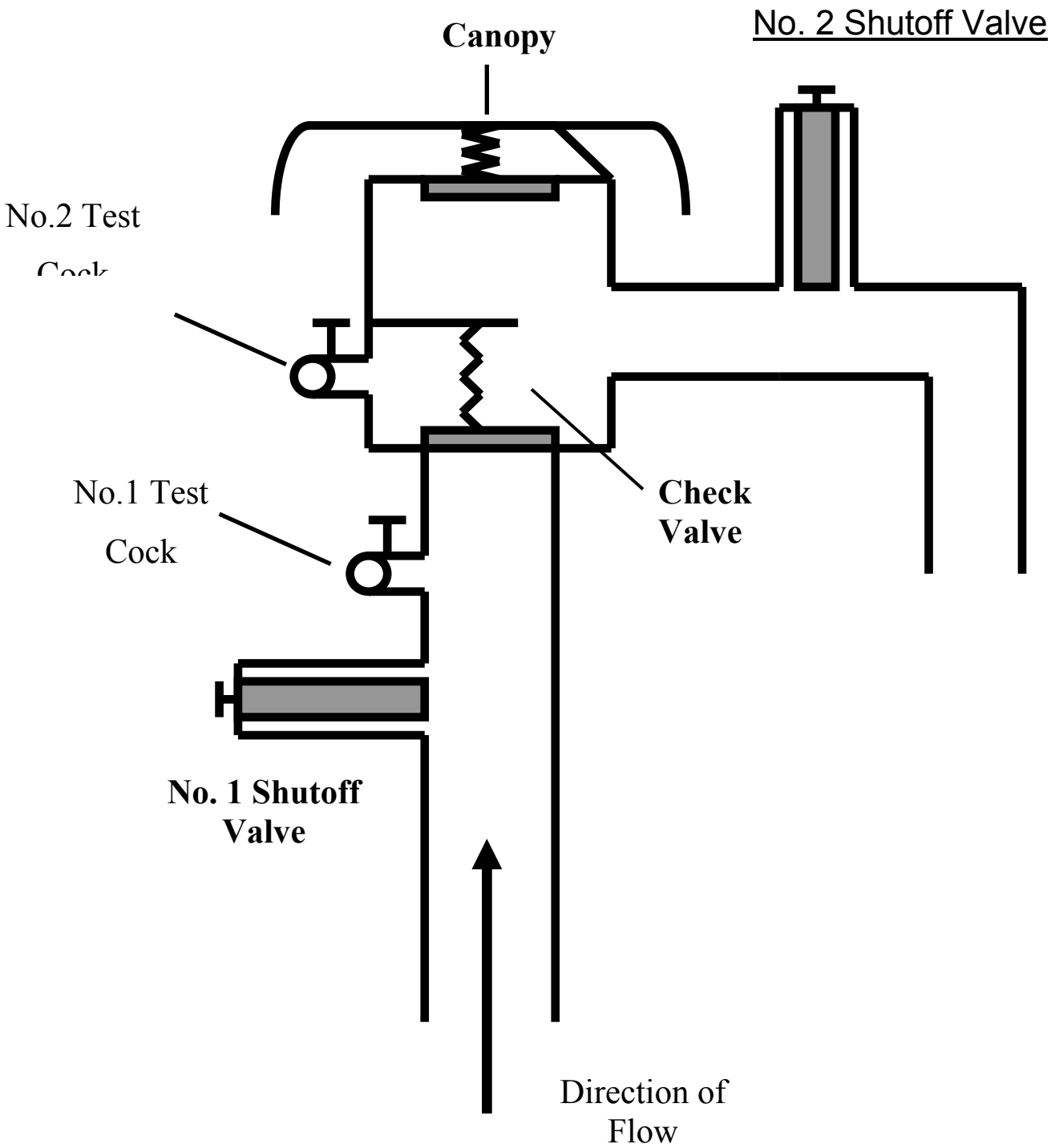
Including a

Differential Pressure Gauge



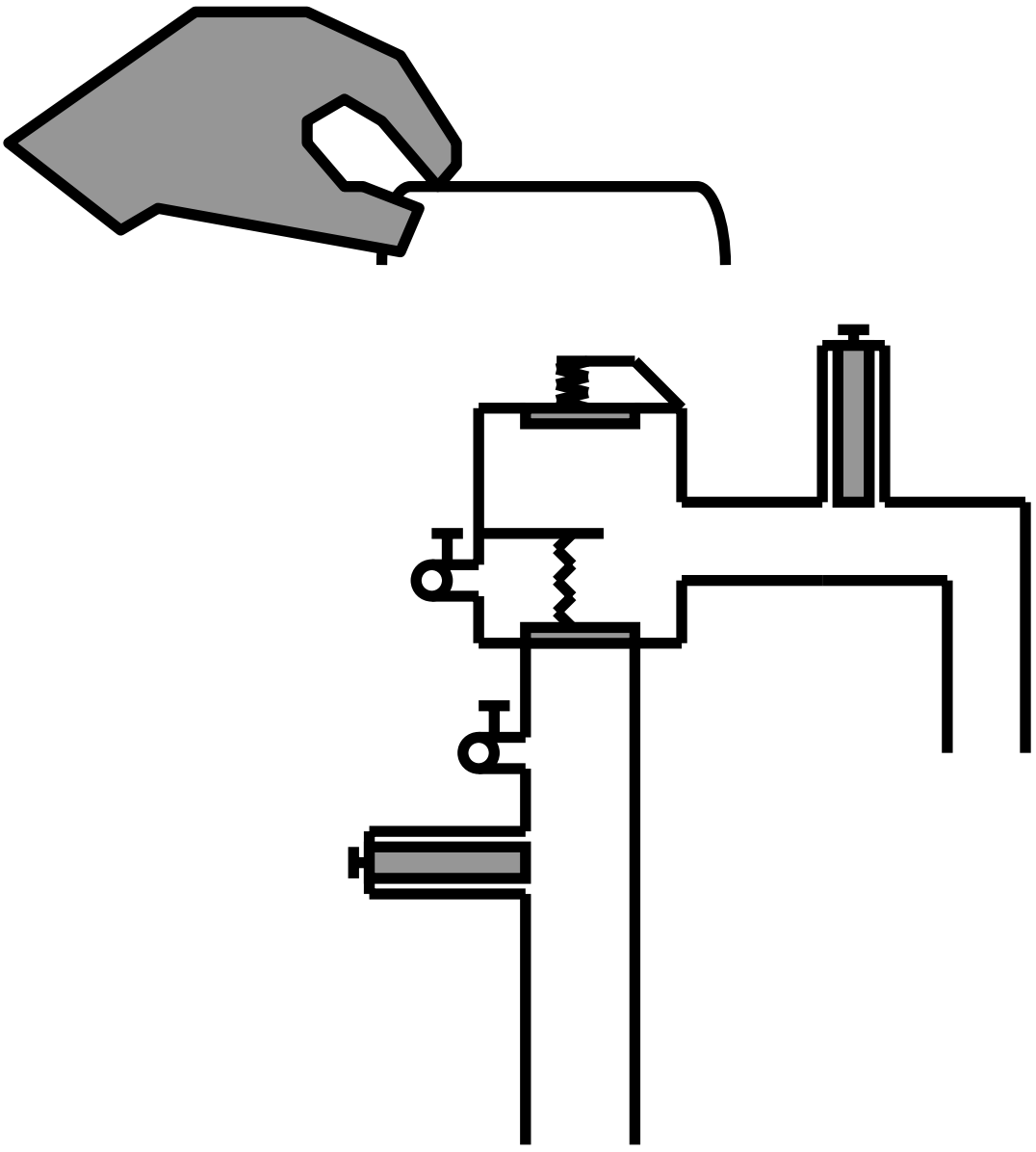
0 **Open** **C** **Closed**

Pressure Vacuum Breaker Assembly

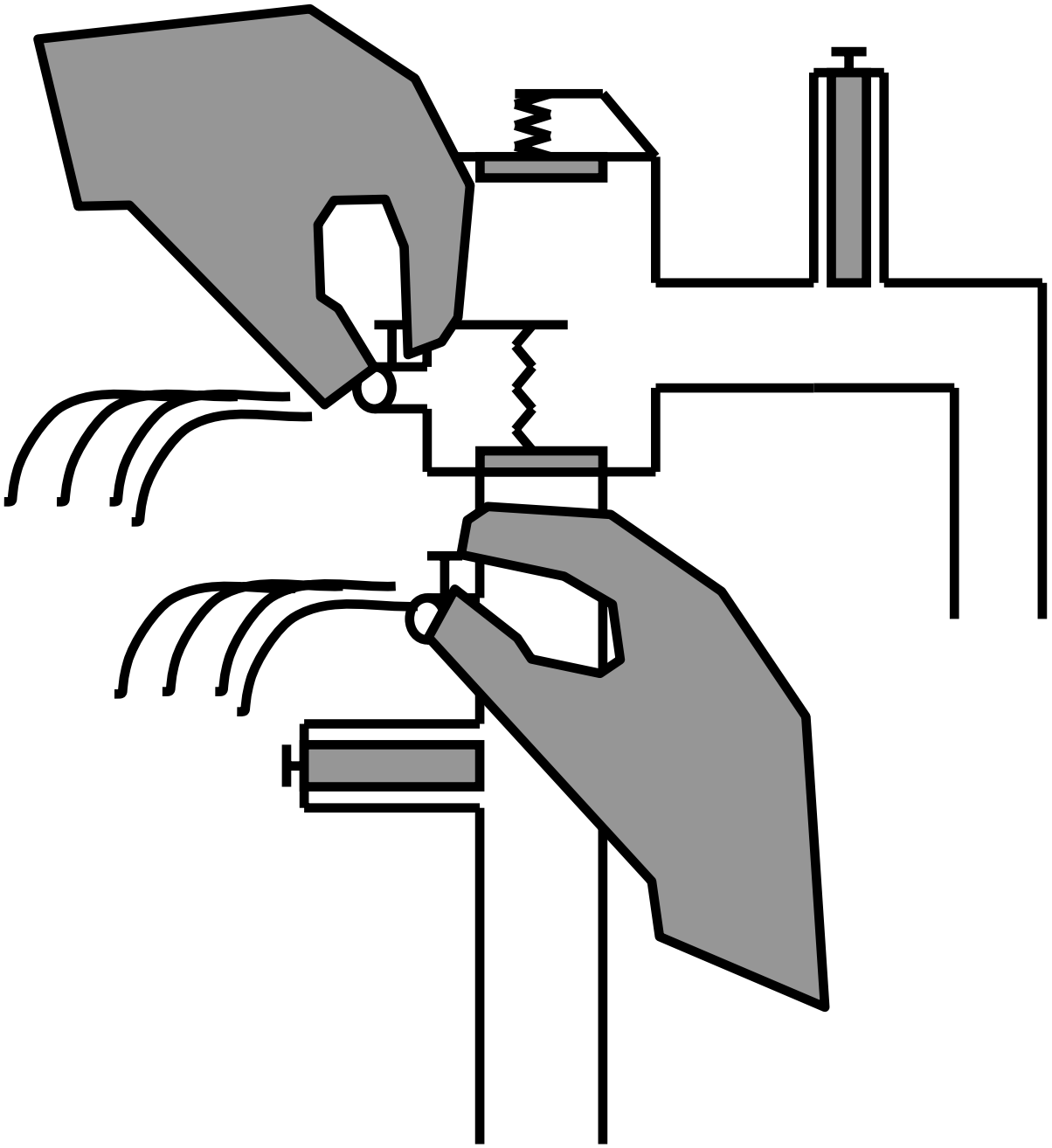


A. Air Inlet Valve Opening Point

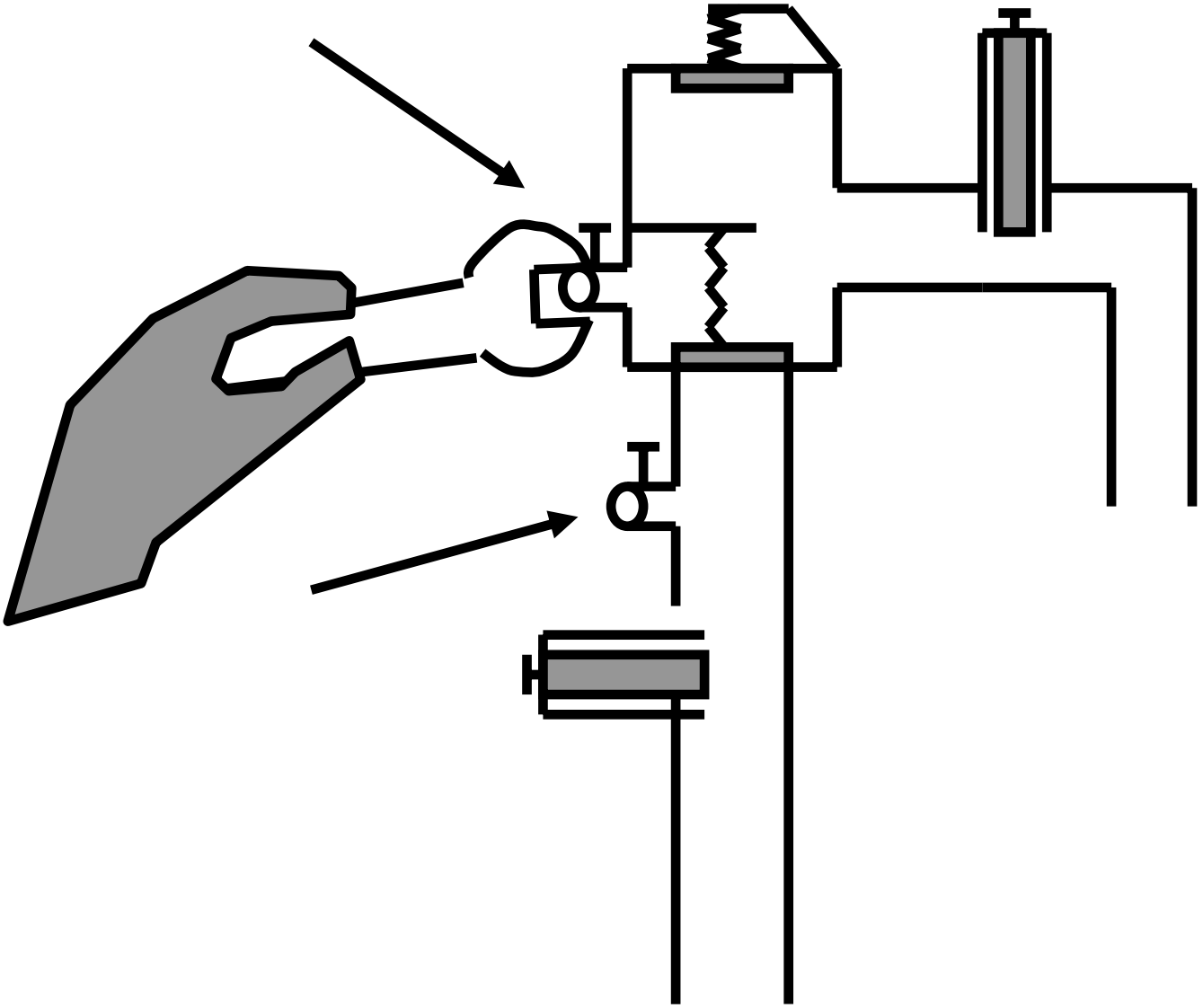
Purpose: To determine that the pressure in the body is no less than 1.0 above the atmospheric pressure. Also to determine if the air inlet valve is fully opening when the water drains from the body.



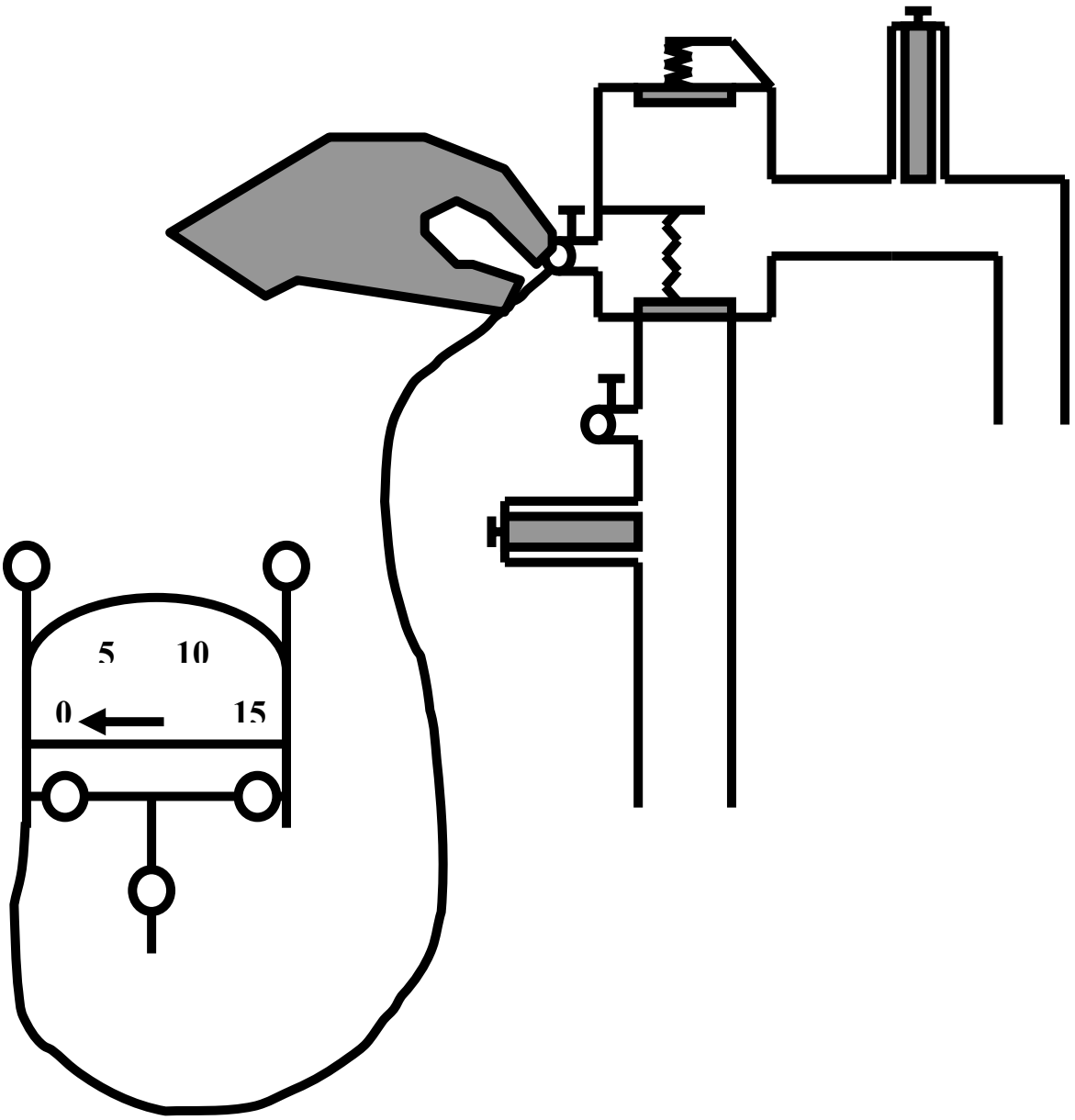
1. Remove the air inlet valve canopy.



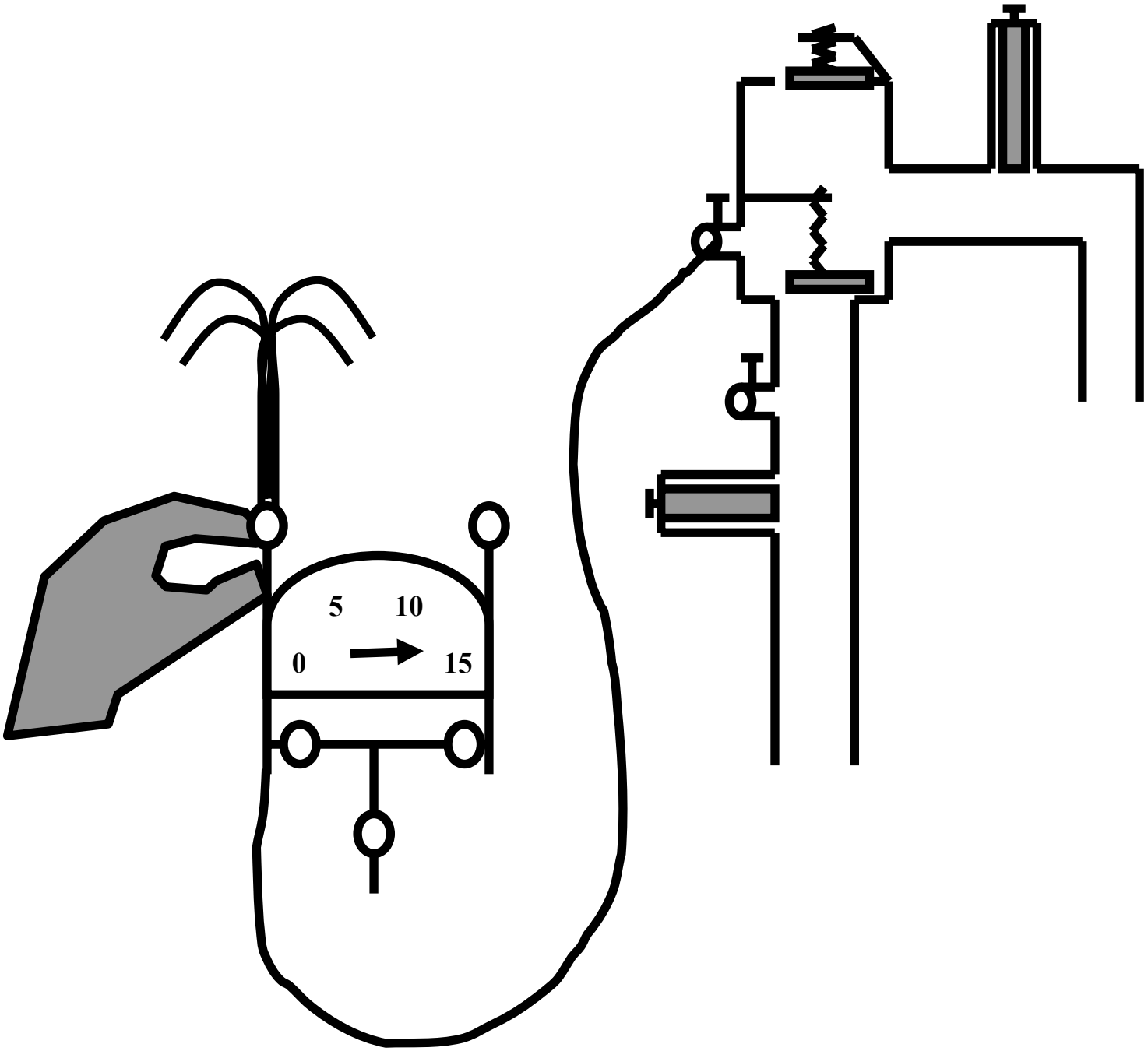
2. Bleed water through both test cocks to eliminate foreign material.



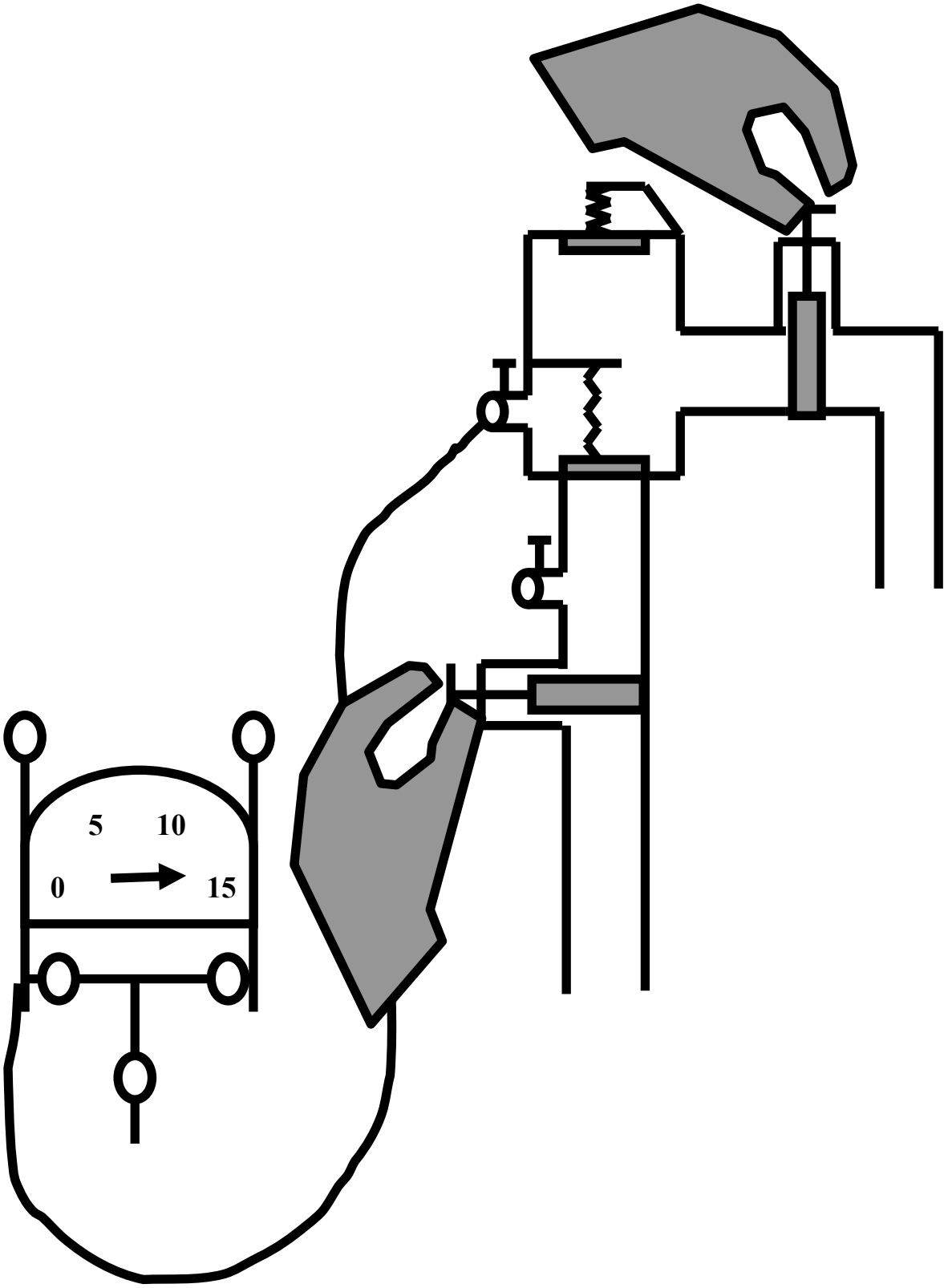
3. Install appropriate fittings to test cocks.



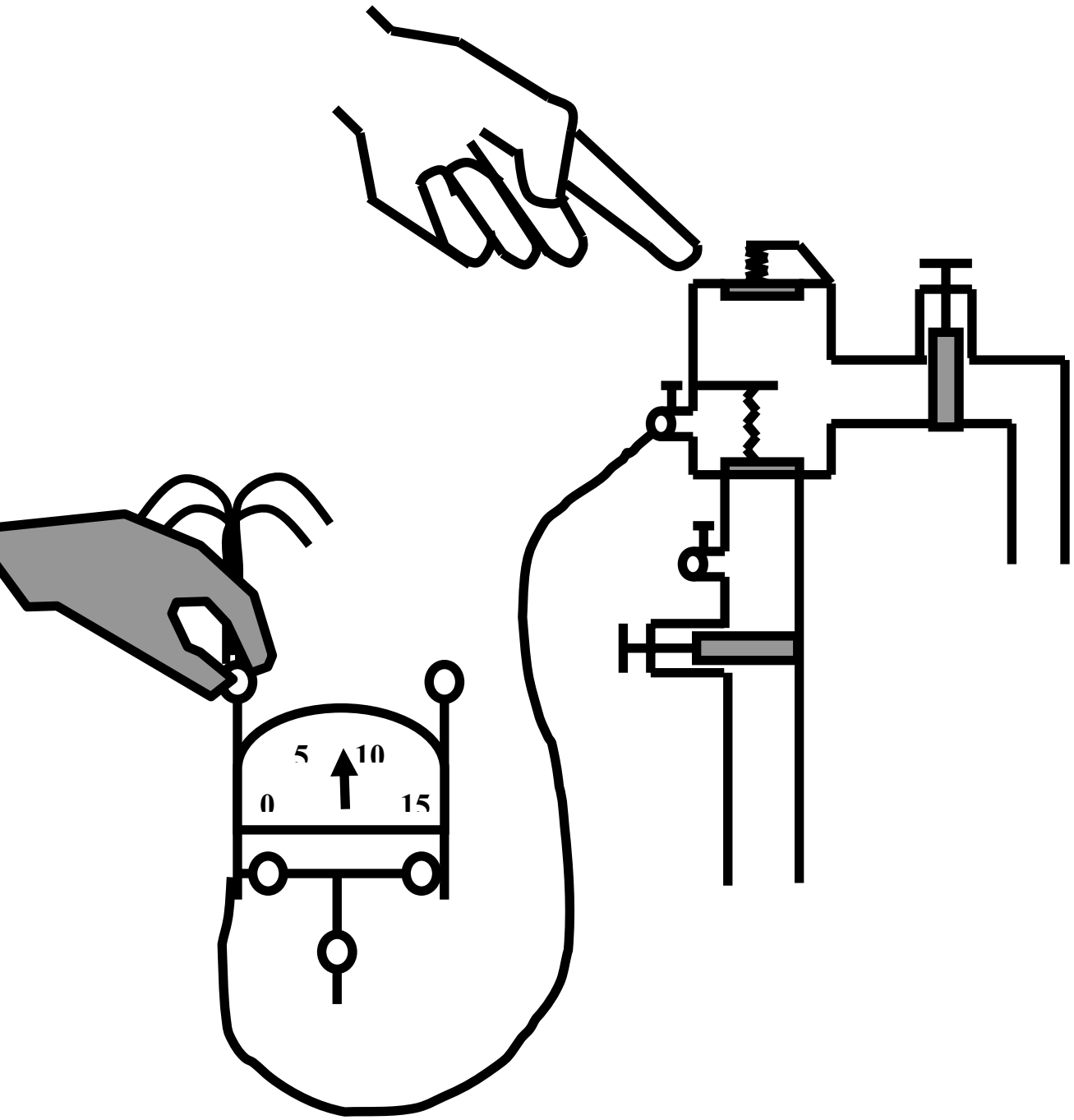
4. Attach the high side hose of the differential pressure gauge to test cock No. 2, open test cock No. 2.



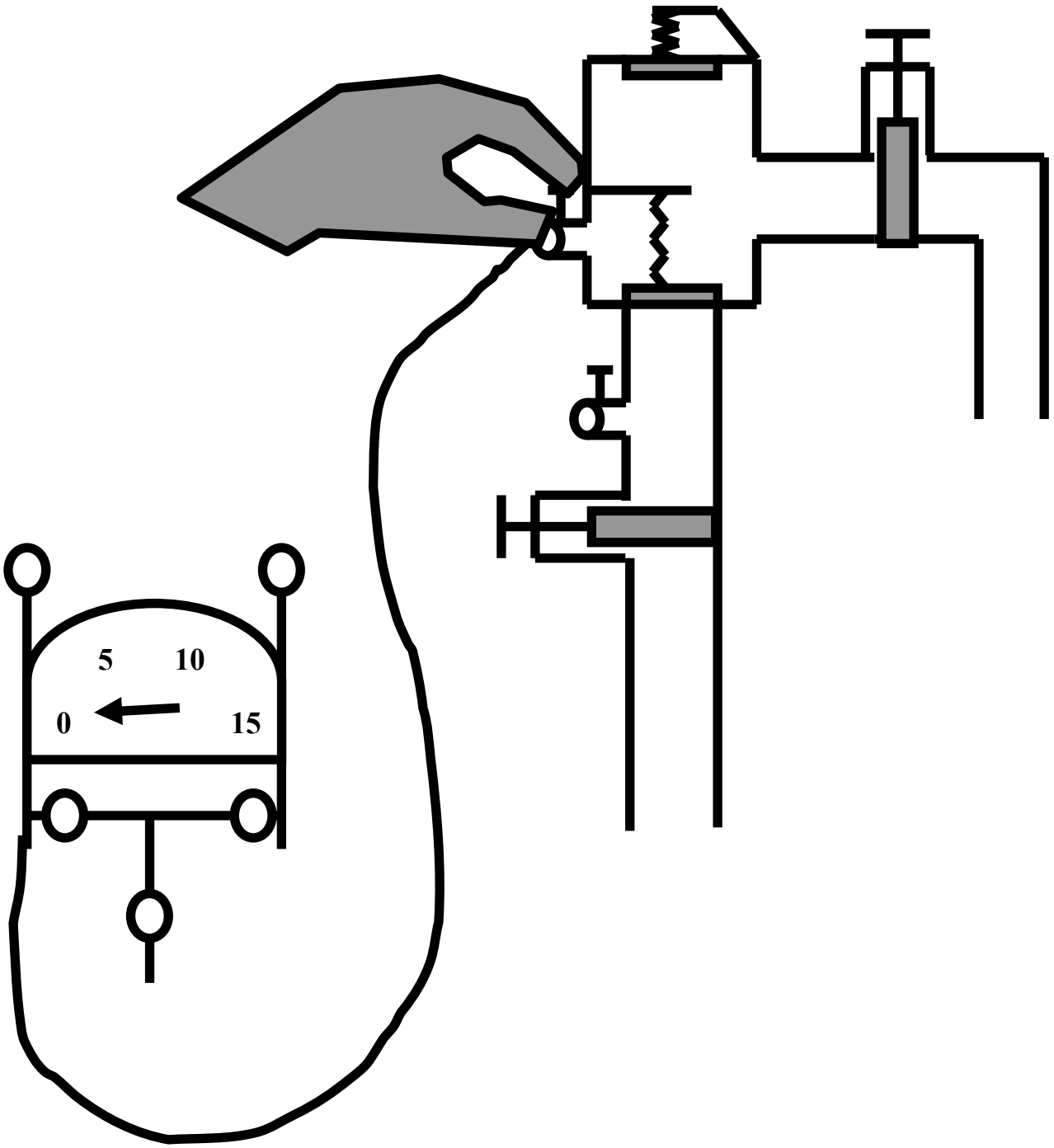
5. Bleed air from the hose and gauge by opening the high side bleed valve. Close the high side bleed needle valve.



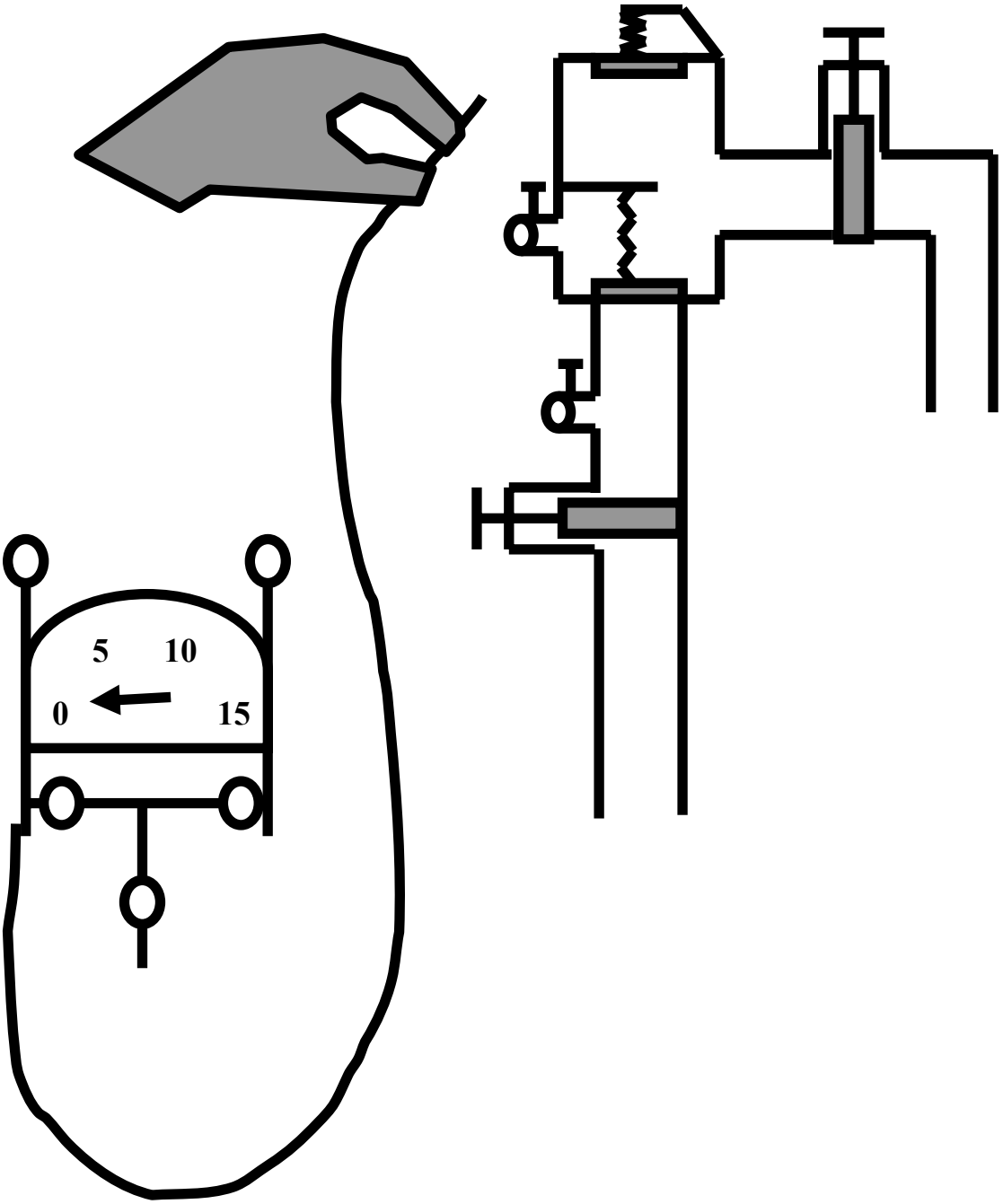
6. Close No. 2 shutoff valve, then close No. 1 shutoff valve.



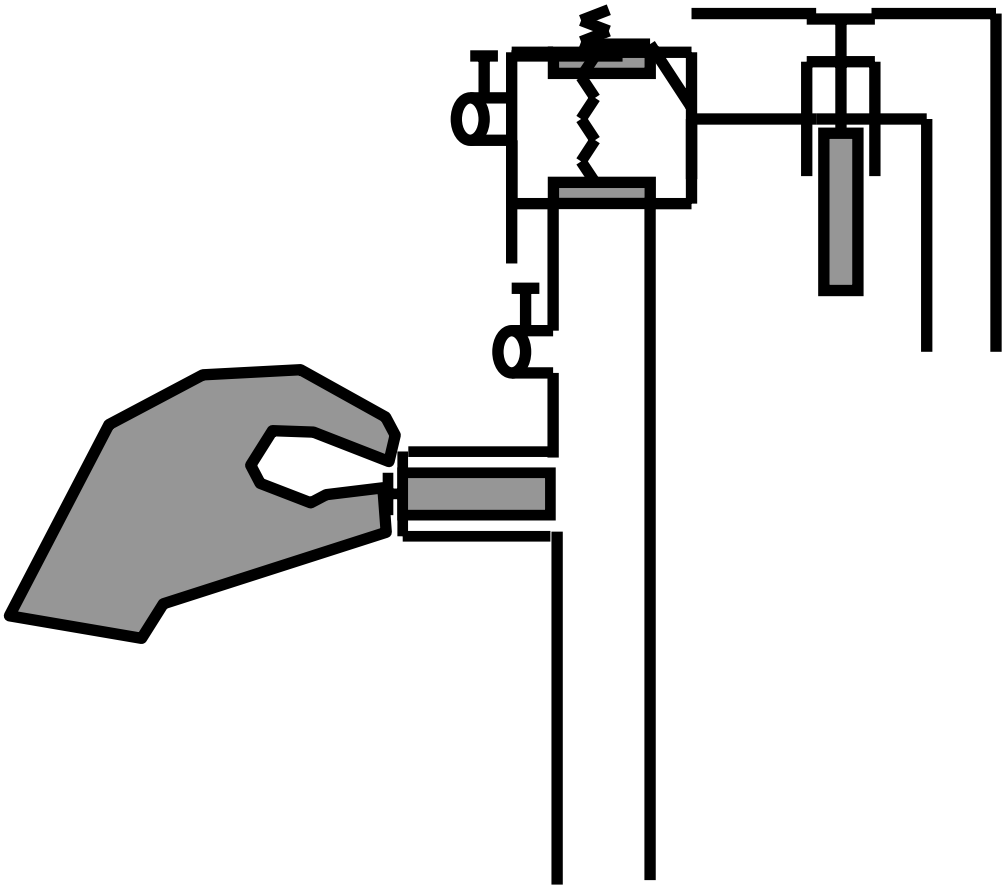
7. Slowly open the high side bleed needle valve no more than one-quarter (1/4) turn, being careful not to drop the differential pressure reading on the gauge too fast. Record the differential pressure reading on the gauge when the air inlet valve opens. Open the high side bleed valve to drain water from body. Observe that the air inlet valve has fully opened.



8. Close test cock No. 2



9. Remove equipment.



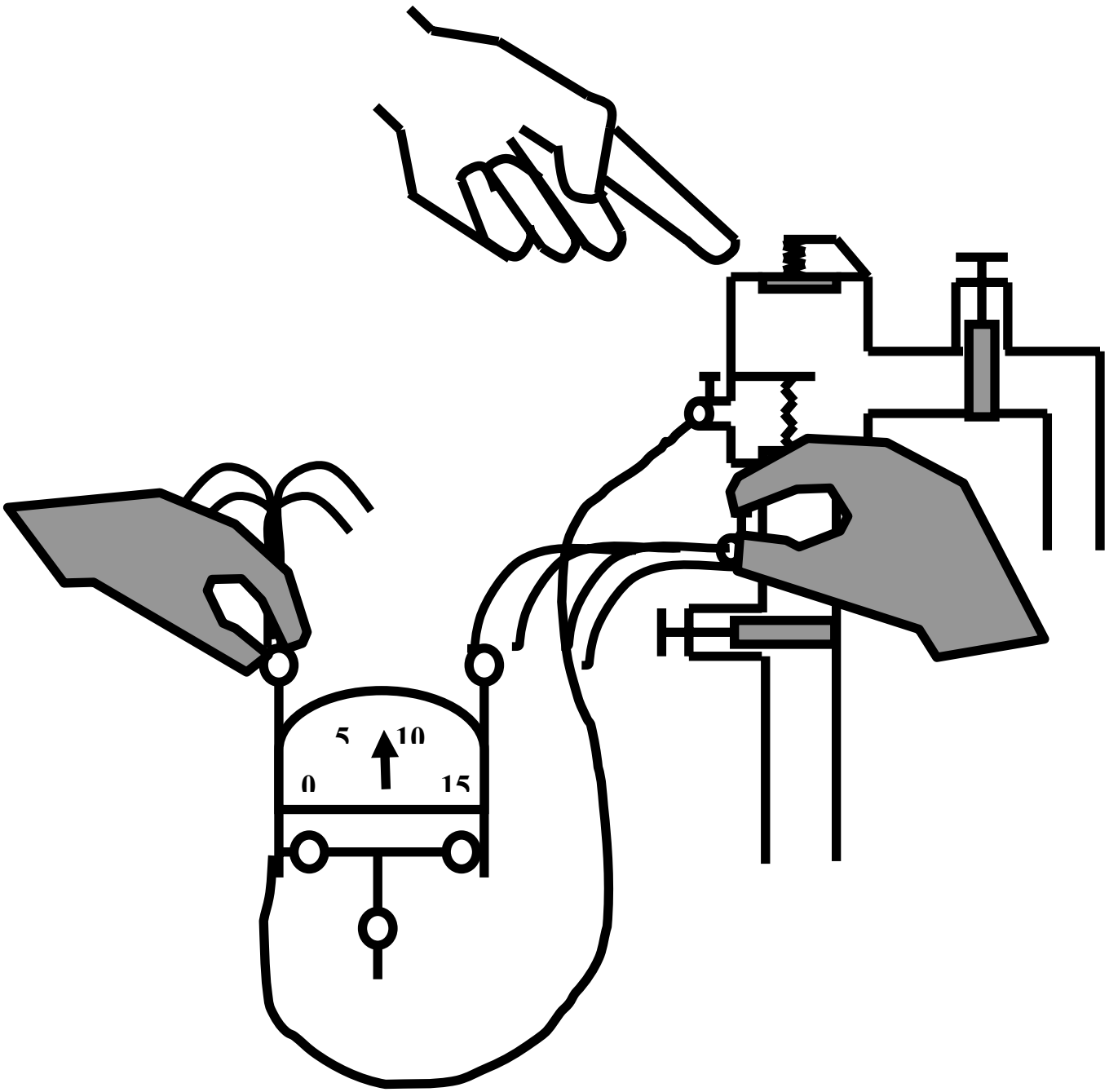
10.Open No. 1 shutoff valve.

Response:

- If air inlet valve opens at a differential pressure greater than 1.0 psi, record on test report and proceed to Section B.
- If the air inlet valve opens at a differential pressure less than 1.0 psi or does not open at all, record on test report as a failed device. If the air inlet valve does not open, as gauge drops to zero psid, the air inlet disc may be stuck to the seat. Other possiblilities include broken of missing air inlet spring or may be the "old style" pressure vacuum breaker a SVB (Spill-resistant Pressure Vacuum Breaker)
- If the high side bleed valve was opened more than one quarter (1/4) turn, it is likely that No. 1 shutoff valve is leaking. Perform the following test: Reopen No. 1 shut off valve and close in an effort to get a better seal. Should the leak persist then the leak must be diverted so that the air inlet valve can be tested. Open the No. 1 test

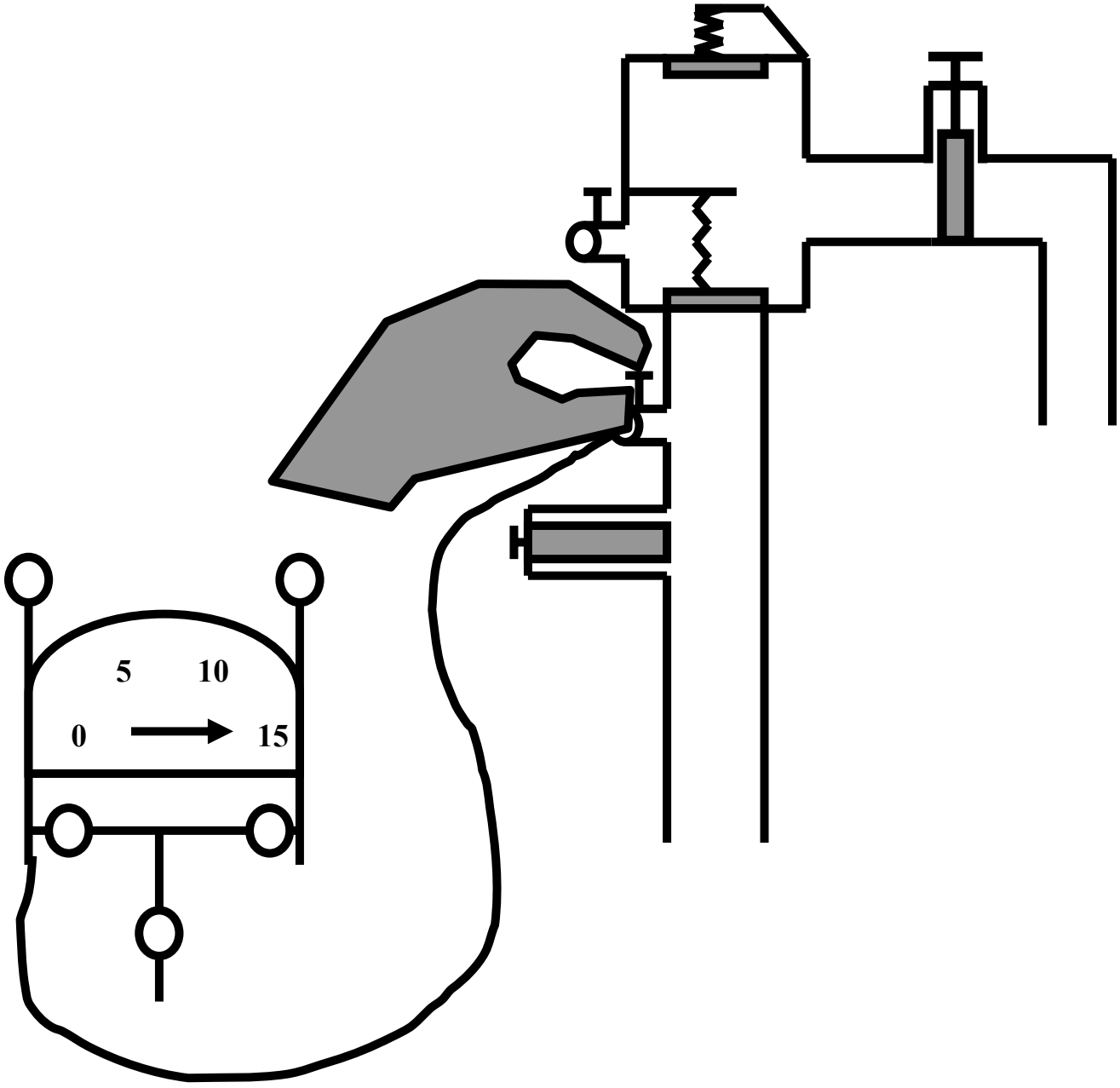
cock slowly to divert the leakage from the No. 1 shutoff valve , monitoring the gauge while this is done once the leakage has been diverted to the No. 1 test cock, continue with Step 7. If the shutoff valve leak exceeds the limit of the No. 1 test cock, then the test cannot be completed until the No. 1 shutoff valve is repaired or replaced.

Leaking No.1 Shutoff Valve –Air Inlet Valve Test

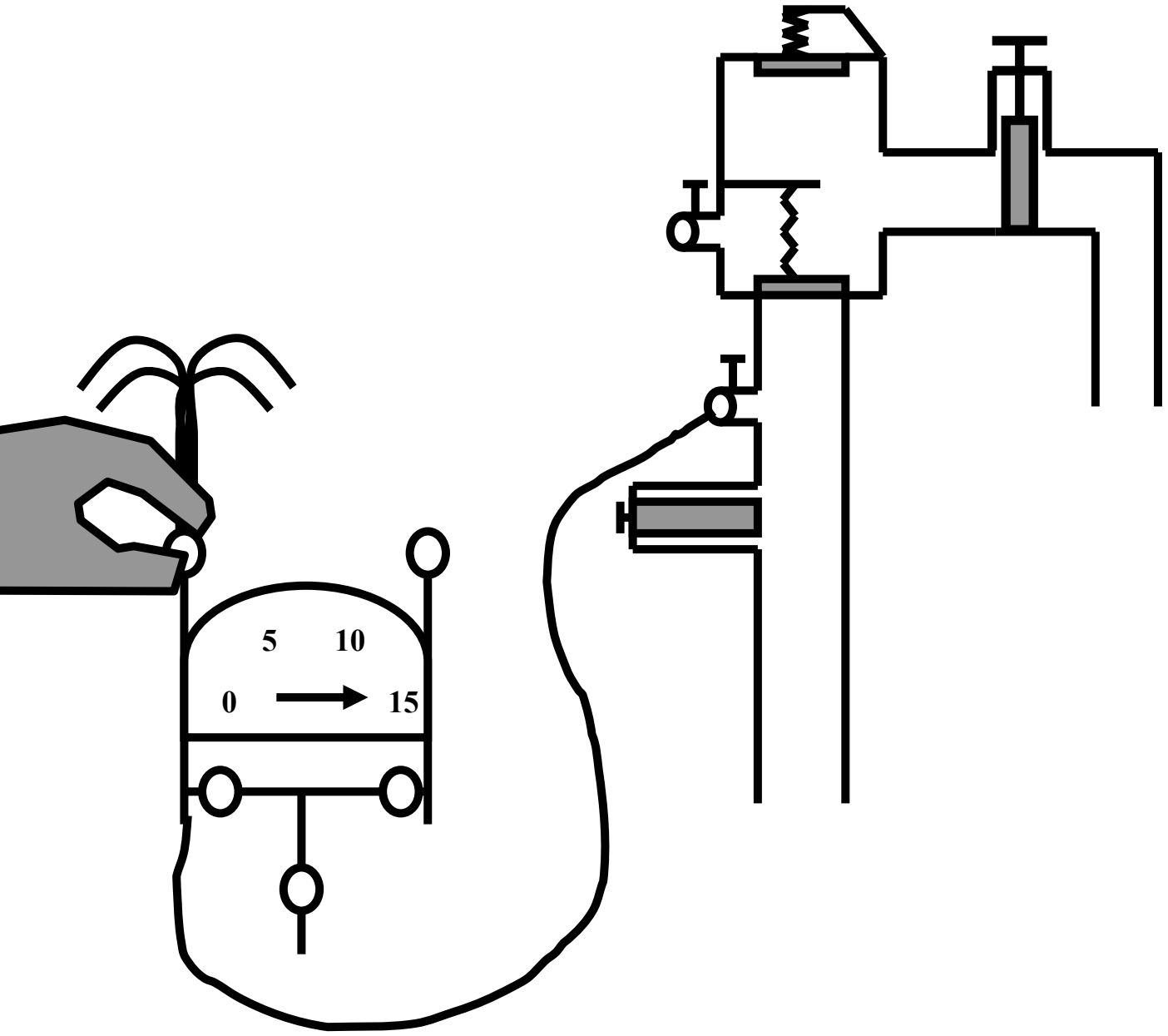


Check Valve Closing Point

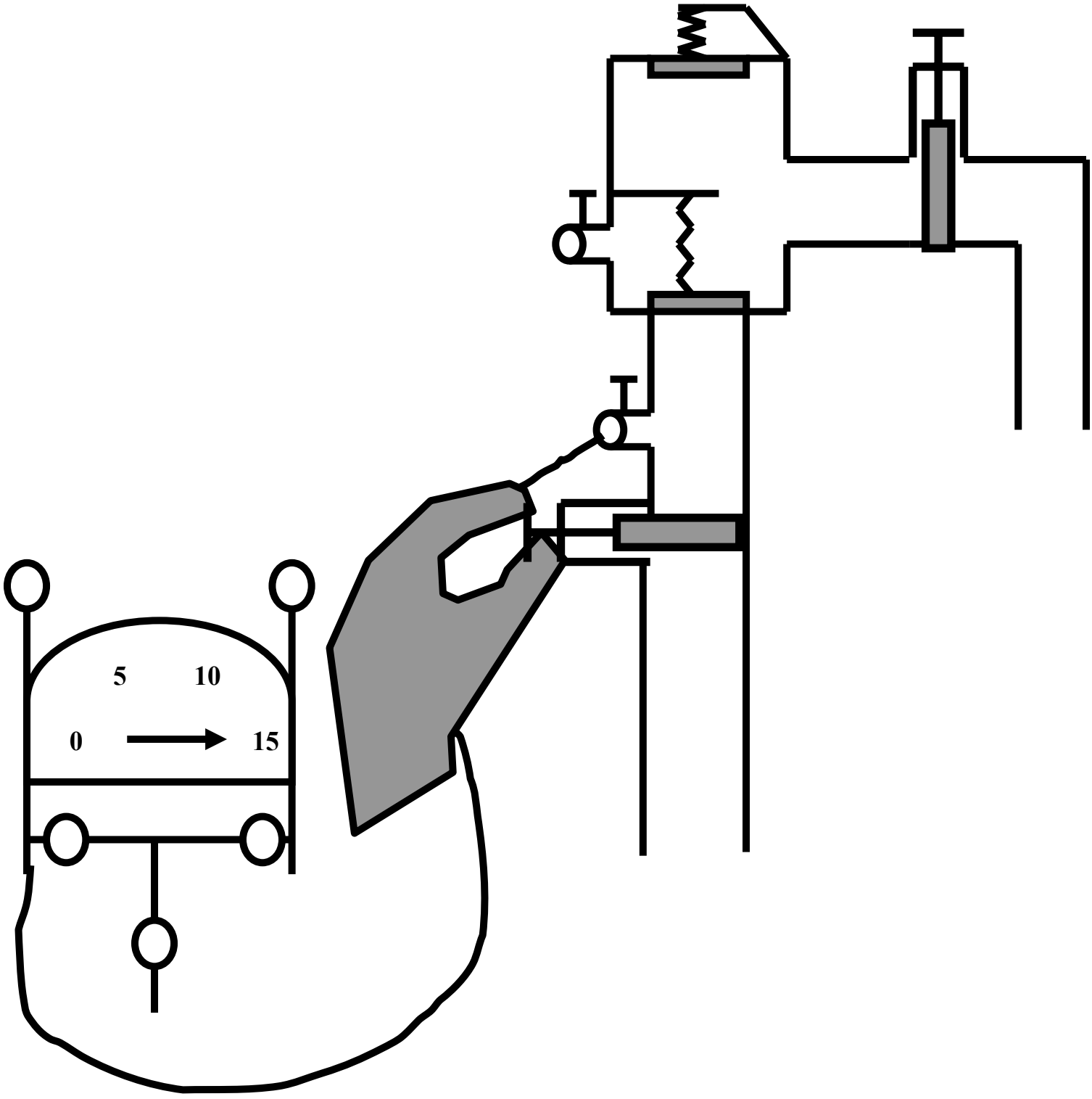
Purpose: To determine the static pressure drop across the check valve.



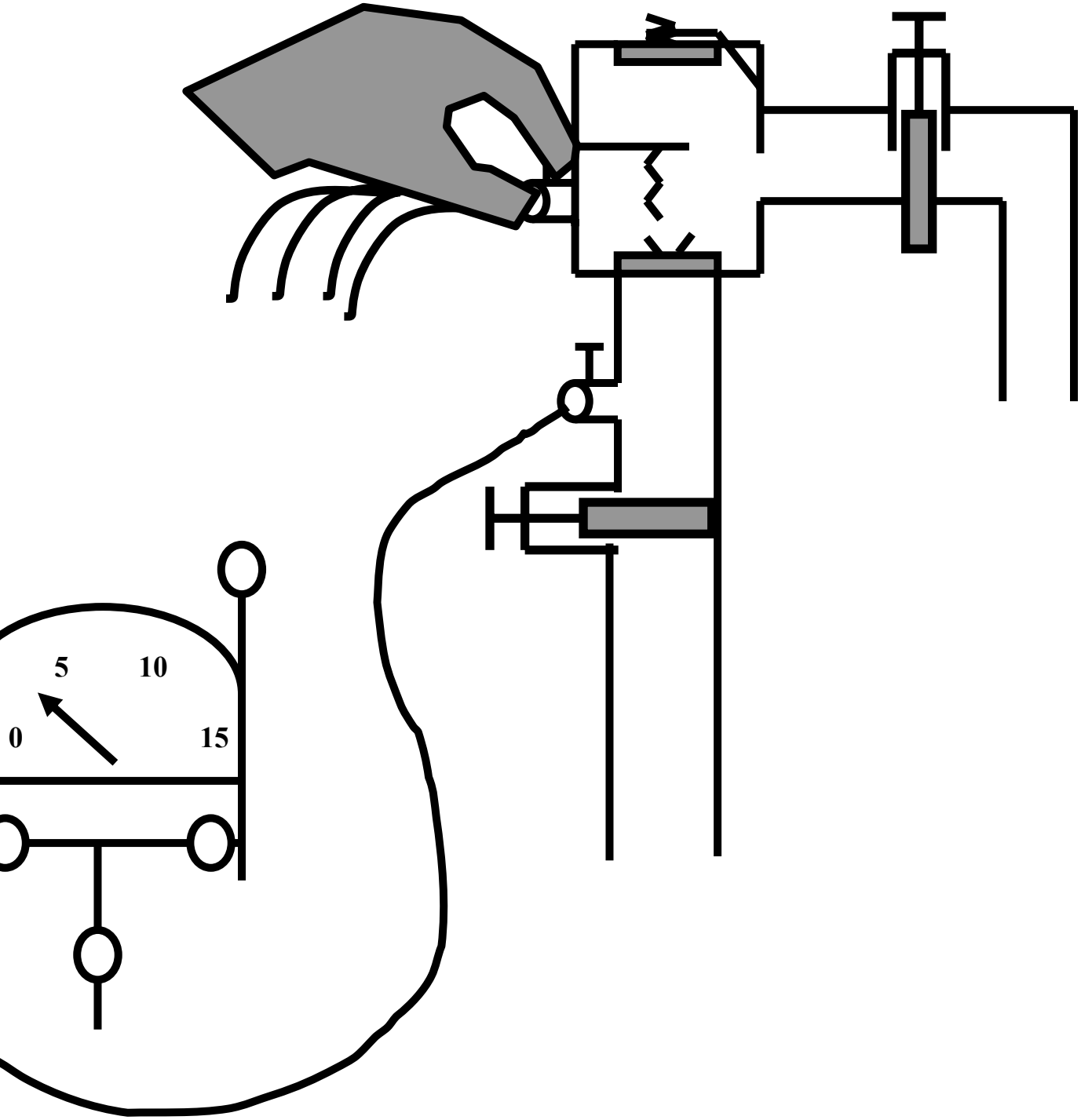
1. Attach high side hose of the differential pressure gauge to test cock No. 1, open test cock No. 1



2. Bleed all air from the hose and gauge by opening high side bleed needle valve. Close high side bleed needle valve.



3. Close No. 1 shutoff valve. (No. 2 shutoff valve remains closed from Test A).

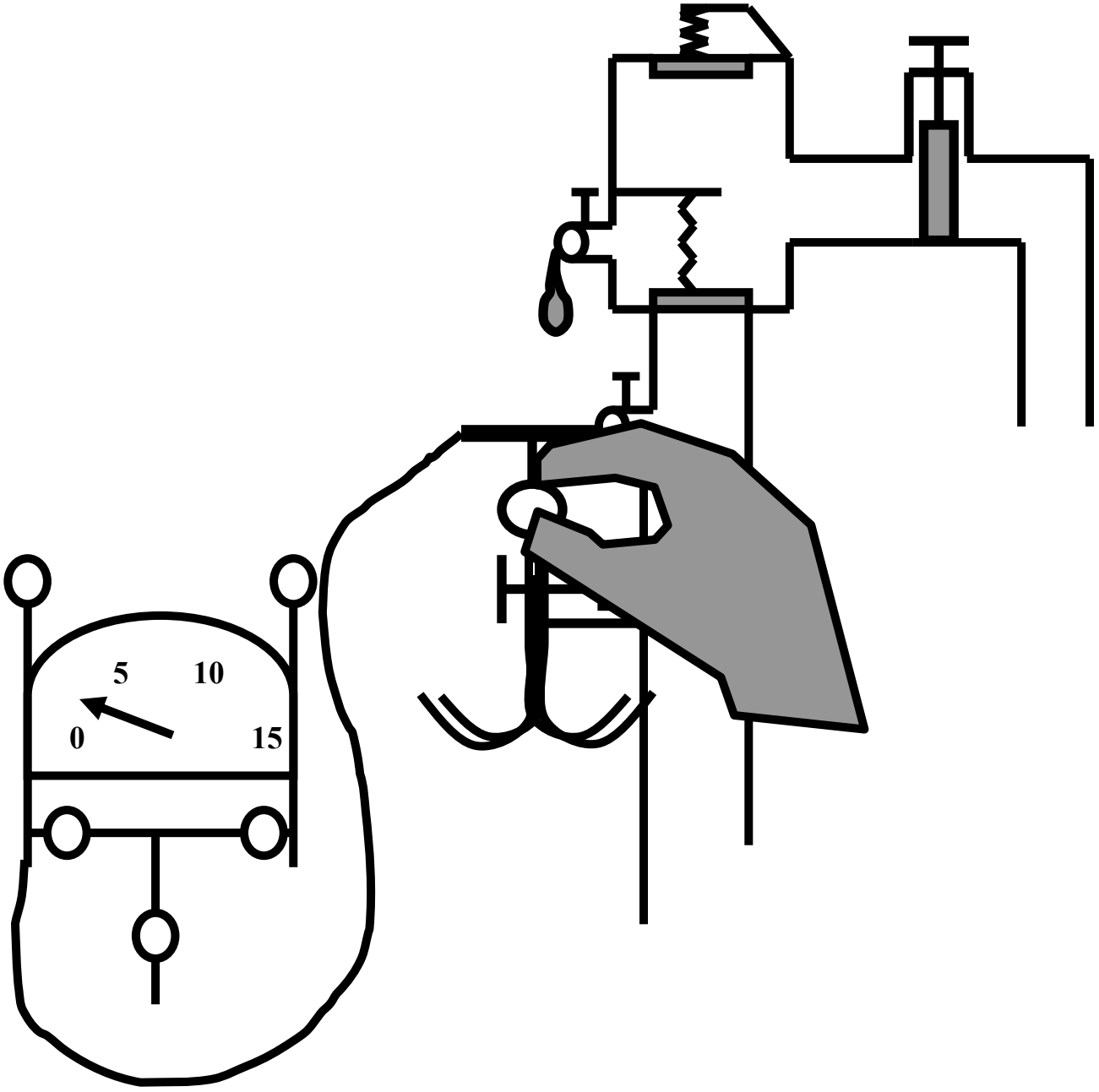


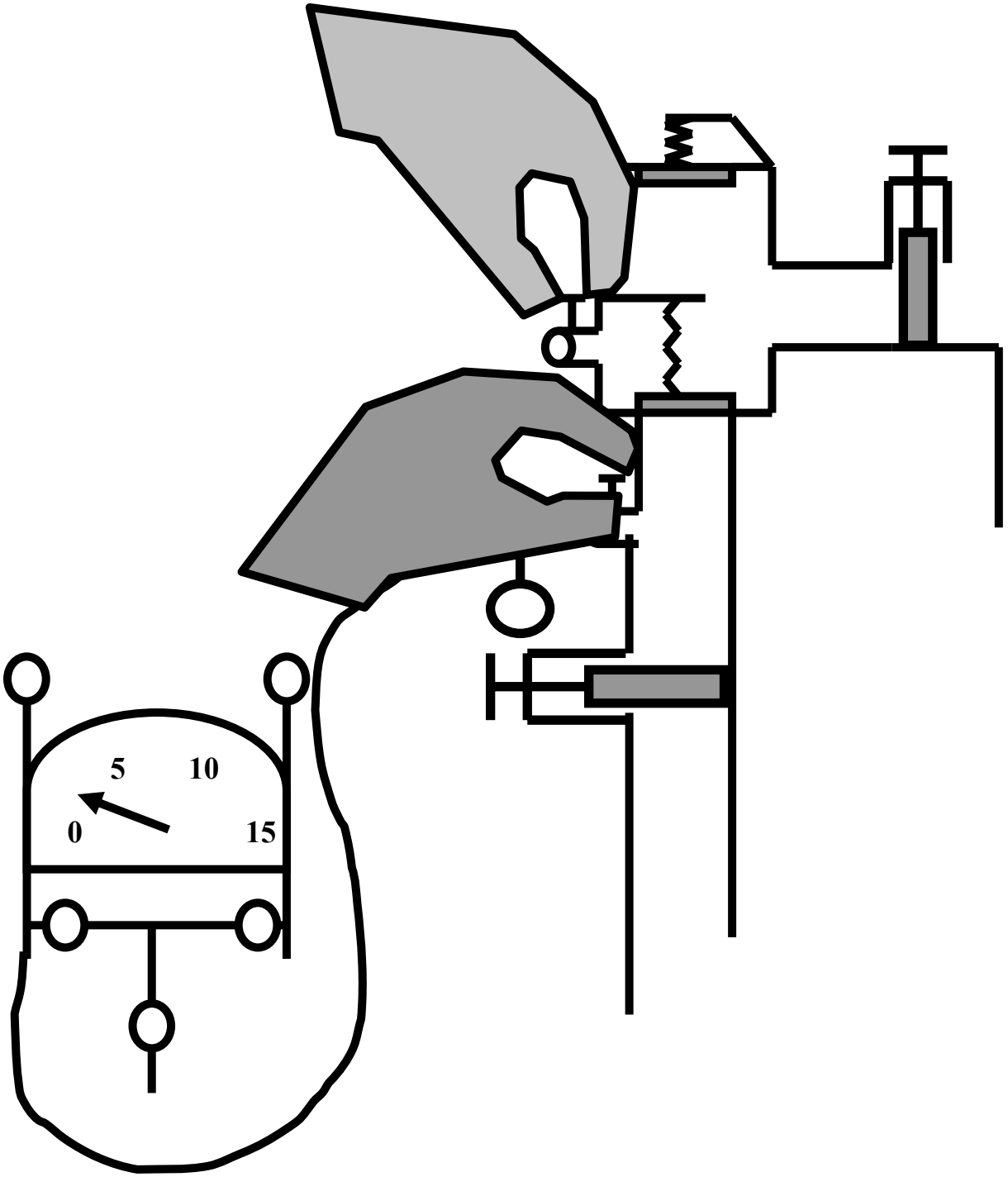
4. Open test cock No. 2. The water in the body will drain out through test cock No. 2. When this flow of water stops, and the differential pressure reading indicated by the gauge settles, the gauge reading will be pressure drop across the check valve.

Response:

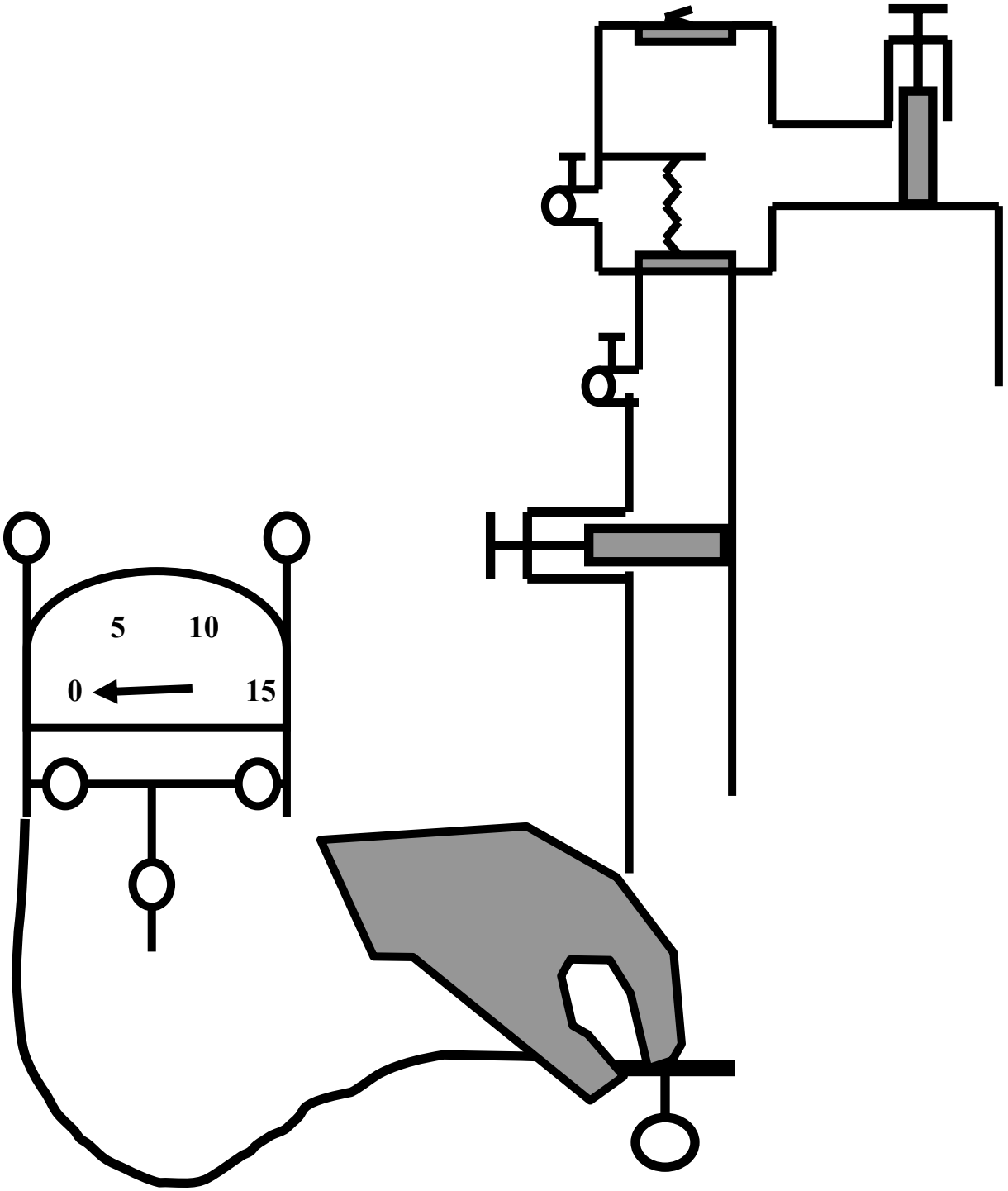
- After the flow of water stops and the differential pressure reading indicated by the gauge settles, record the gauge reading on the test report. This will be the pressure drop across check valve No. 1. A gauge reading of 1.0 psid or greater indicates the check is holding tight.
- If the gauge reading is below 1.0 psid, the device fails. Record on test report. Possible problems include a dirty or damaged check disc or a damaged valve seat.
- If water continues to flow out of test cock No. 2, this indicates that the No. 1 shutoff valve is leaking. Perform the following test: Install bleed-off valve to test cock No. 1 and attach high side hose to bleed-off valve. Open test cock No. 1. Slowly open bleed-off valve until the flow of water from test cock No. 2 is a slight drip. Record the reading on the differential gauge as the static pressure drop across the check valve. If the flow of water from test cock No. 2 can not be eliminated by opening the bleed-off valve, then the tightness of the check valve can not be determined. The shutoff valve No. 1 must be repaired or replaced.

Leaking No. 1 Shutoff Valve-Check Valve Test

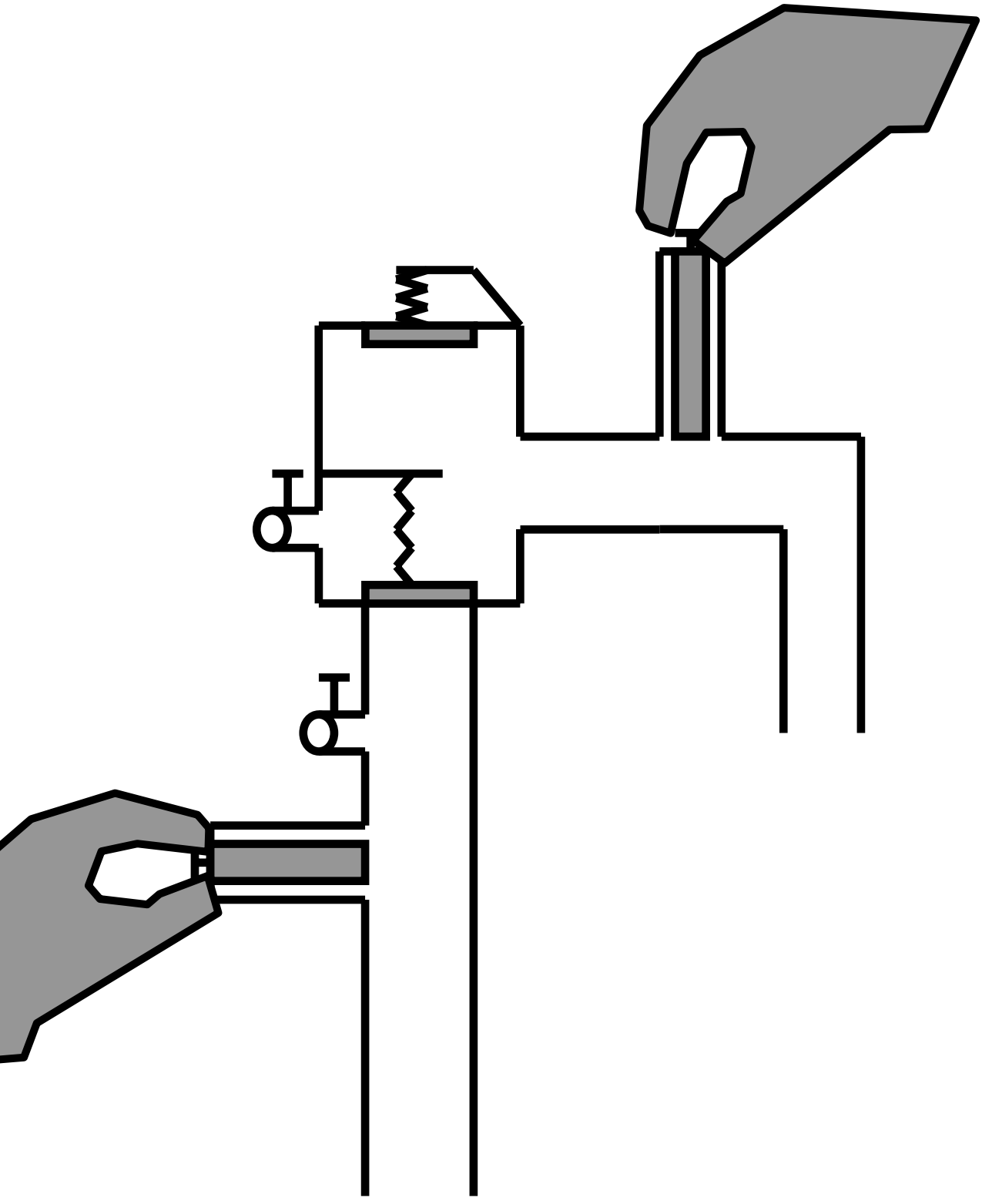




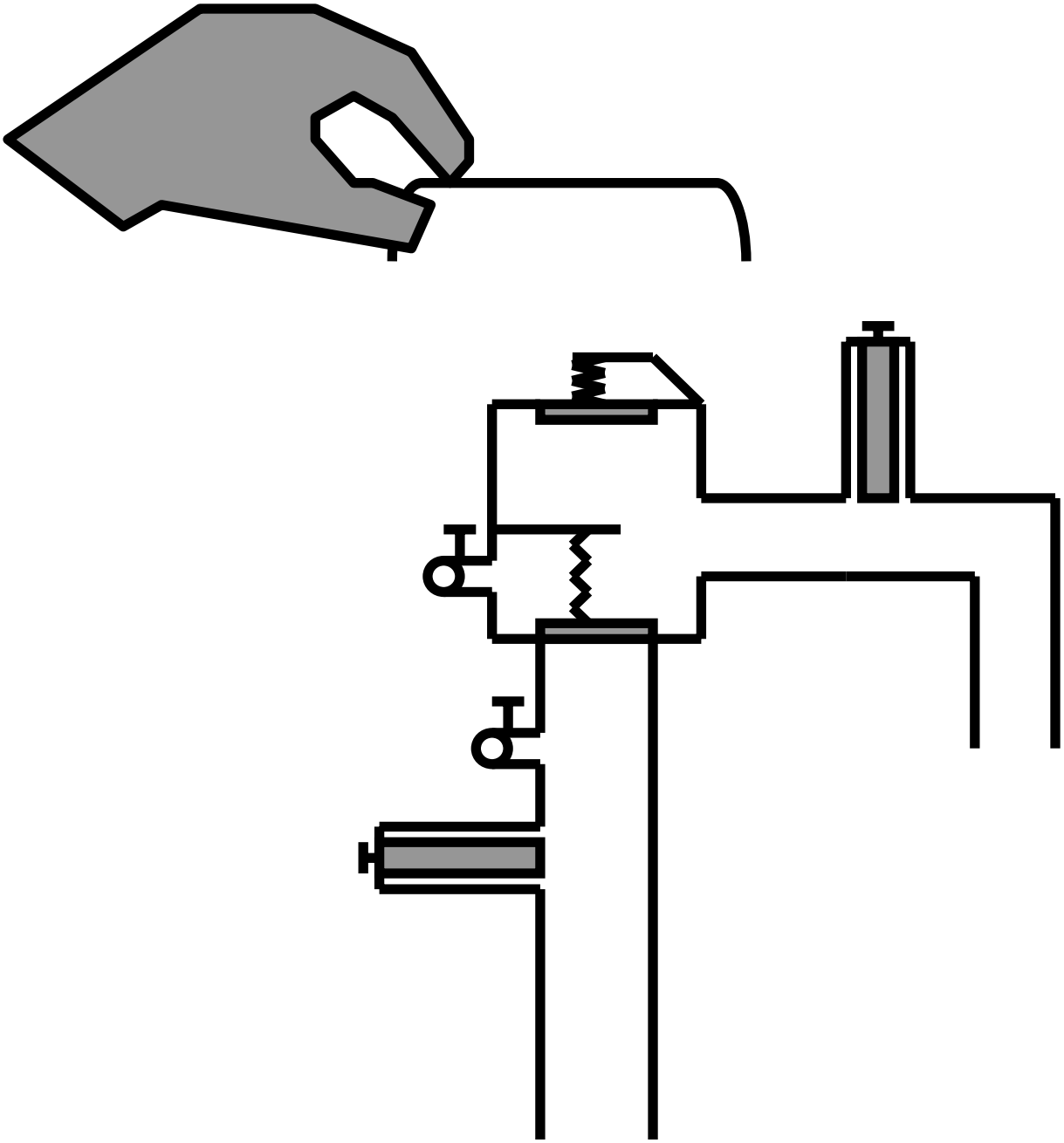
5. Close test cocks No. 1 and No. 2.



6. Remove equipment.



7. Open No. 1 shutoff valve, then No. 2 shutoff valve.



8. Replace air inlet valve canopy.

Fleming Training Center

Course Evaluation Form

Course Title: ____Cross Connection Control_____
Date: _____
Location: _____

	Brent Ogles			
The material was presented in a very clear manner.	Yes No	Yes No	Yes No	Yes No
The material was presented at an appropriate understanding level for the group.	Yes No	Yes No	Yes No	Yes No
The session presented practical information.	Yes No	Yes No	Yes No	Yes No
The instructor was knowledgeable about the topic.	Yes No	Yes No	Yes No	Yes No
Your questions were welcomed.	Yes No	Yes No	Yes No	Yes No
Your questions were answered satisfactorily.	Yes No	Yes No	Yes No	Yes No
The instructor was prepared.	Yes No	Yes No	Yes No	Yes No
The instructor communicated well.	Yes No	Yes No	Yes No	Yes No
The materials (books, handouts, videos) were helpful.	Yes No	Yes No	Yes No	Yes No
Would you recommend this class to others?	Yes		No	
Overall, please rate the course. ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ Poor Fair Good Excellent				

What would you like to see added to this class? _____

_____

Additional comments: _____

_____